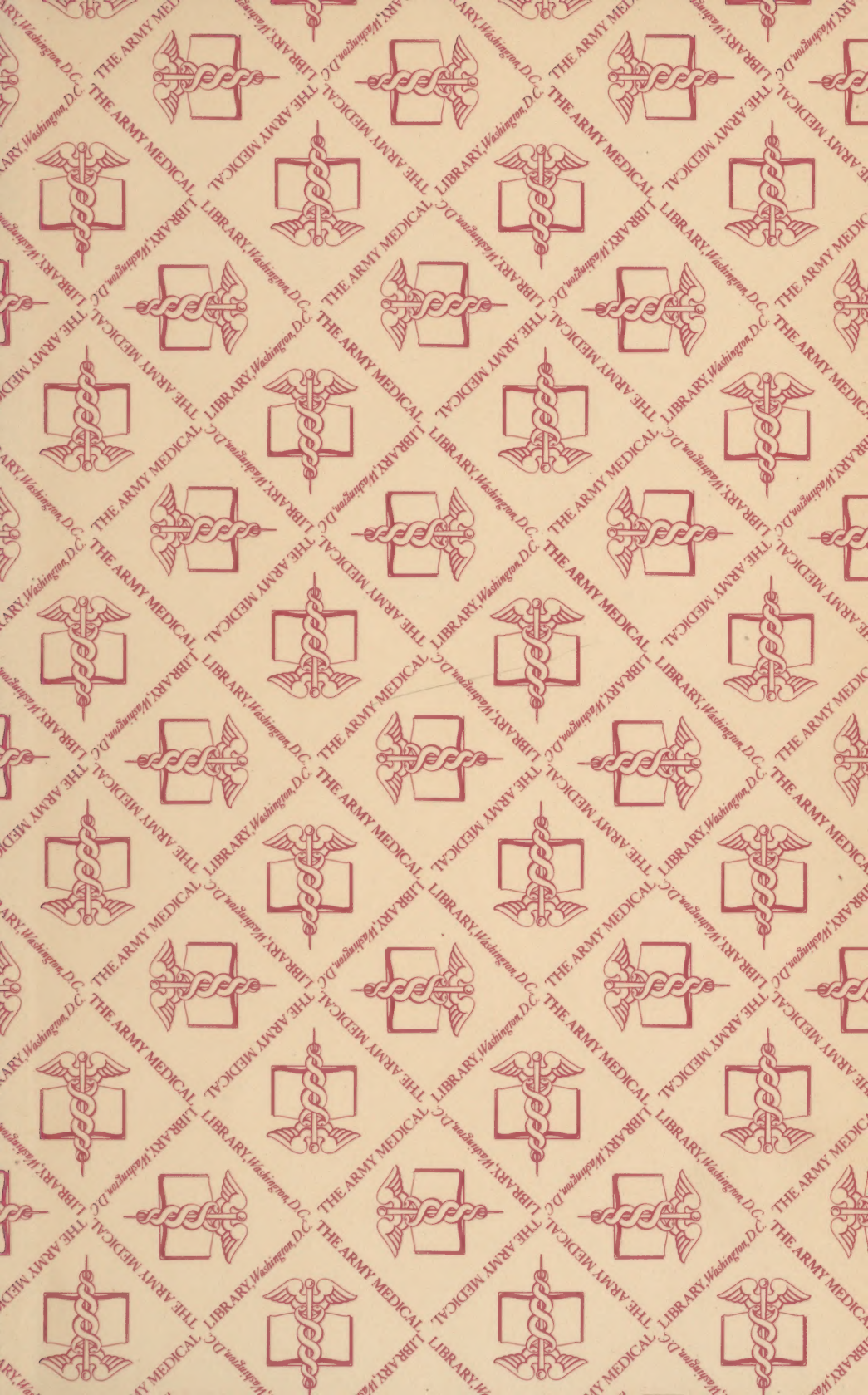
HANDBOOK

FOR THE

Dental Assistant

AND

Mechanic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HANDBOOK

for the

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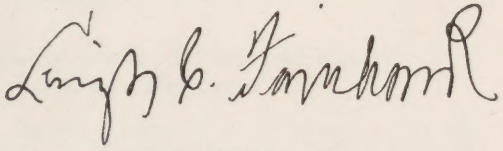
FOREWORD

Many complex problems confront the Dental Corps at the present time in the development of its various activities in the expansion program. One of the principal problems concerns the development of our laboratory service and the training of our dental technicians and enlisted personnel who are trained as dental assistants. The entire training program depends very largely upon a standardization of our dental service. This even involves all the activities of our enlisted personnel.

The chapters in this Manual cover the essential phases and all activities of our dental technicians and chair assistants. The lectures were prepared as a part of the activities of the Army Dental School, Colonel Lowell B. Wright, Director, with the collaboration of officers of his staff.

The collaboration of both the Army Dental School and the American Dental Trade Association in the publication of these lectures is gratefully acknowledged.

For The Surgeon General:



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DENTAL PROSTHESIS

CHAPTER I

Section I

General

1. *Scope*

The term *prosthetic dentistry* or *prosthodontia* may be defined as that branch of dentistry which has to do with the replacement of any lost or missing parts of the dental apparatus by suitable artificial substitutes. Dental laboratory mechanics is that part of the science or art of prosthodontia which has to do with the construction of these appliances. The instructions contained in this section of the manual include the laboratory procedures for the construction of full dentures, partial dentures, crowns, bridges, and splints. A full denture may be defined as a structure replacing the full number of teeth in either jaw. A partial denture is a structure replacing the missing natural teeth in either jaw and is retained by mechanical means against the remaining natural teeth. A crown is an artificial restoration of the crown of a natural tooth. A bridge is a fixed appliance which replaces lost teeth, retained by attachments other than clasps to abutments supported by the roots or crowns of adjoining teeth. A splint is any apparatus, appliance, or device employed to prevent motion or displacement of fractured or movable parts.

Section II

Impression Materials

2. *Description and Limitations*

An impression is an exact negative reproduction of a patient's oral arch and teeth. A positive form or cast is obtained from the impression that is identical to the mouth. The first contact that the dental technician has with the work which he has to per-

form is when he receives the completed impression from the dental officer. As a great deal of painstaking care is needed to secure an accurate impression, the importance of skillful handling of the impression by the technician cannot be stressed too much. Any deviation from this, will result in the completed denture being unsatisfactory. In an edentulous or toothless mouth there are usually no undercuts present, or at least very few. Therefore, no great problem is presented in getting the impression from the mouth. For this reason a material such as modeling compound can be used. This material becomes plastic upon the addition of heat, and returns to its hard state when allowed to cool in the mouth. However, a dental arch containing some natural teeth presents quite a different problem; that is, one concerning the selection of a suitable impression material. As can be seen by looking in any mouth, there are always undercuts when natural teeth are present. If an impression of this type was taken in modeling compound, it would be very difficult to remove and when once removed, it would be distorted to such an extent as to render it useless. Therefore, another type of impression material must be used. There are two materials commonly used for this type of case, each having entirely different characteristics, but both giving equally good results. The first is plaster of paris, which is placed in the mouth while in its plastic stage and allowed to set. It is then broken into several fragments, which permits its removal from the mouth, and, at the same time, preserves the details of all the undercuts. These fragments are later reassembled in their proper relationship, which gives an accurate reproduction of the dental arch. The other type of impression material is the hydro-colloid. This material can be softened by moist heat, placed in the mouth, and allowed to cool. Due to its great elasticity, it can be removed over the undercuts without any distortion of the impression. Various combinations of materials may also be used, and these will be discussed later.

Section III

Plaster Impressions

3. *General*

Plaster impressions for partial dentures consist of several pieces that must be reassembled in the tray in their proper position and relationship. Great care must be taken in the handling of these

broken fragments, as any further breakage or rubbing of the edges will seriously interfere with the accuracy of the impression. The steps taken in the assembling of the plaster impression are as follows:

4. *Assembling of Parts*

(1) Allow the fragments to dry before beginning to assemble the impression.

(2) Remove all crumbs of plaster from the tray.

(3) Gently remove all adhering particles of plaster from the fractured edges of the impression with a camel-hair brush.

(4) Assemble the parts in the tray consecutively so as to avoid undercuts. Never force any fragment in position, as this will mar the edges. If the pieces are assembled in the proper order, they will easily slip into their correct places.

(5) After the parts are assembled in the tray, apply a slight amount of finger pressure on the various pieces of plaster so that the lines of fracture are barely noticeable. Be sure that the entire impression fits snugly in the tray.

(6) Maintain this pressure, and, with a warm spatula, carefully apply sticky wax to join the edges of the impression to the tray. Never allow the wax to touch the tissue surfaces of the impression.

(7) With a camel-hair brush, apply an alcoholic solution of orange shellac to the impression. It must be thin enough to penetrate the plaster to a slight degree without obliterating any of the fine details. This is used as a staining medium. Allow to dry.

(8) With a camel-hair brush, apply a coat of sandarac varnish over the shellacked surface of the impression and allow to dry. It should be thin enough so as not to obliterate the fine details. The varnish may be made thinner with a little alcohol, if necessary. This is used as a separating medium and the impression should now have a glossy, smooth finish. A solution of soap in water may be used in place of sandarac varnish as a separating medium.

5. *Boxing*

The impression is now ready to be "boxed" preparatory to the pouring of the model. By this step the impression is reenforced by a retaining wall which confines the stone to the impression and simplifies the trimming of the cast after it is poured.

(1) With a sharp knife, cut a strip about three-sixteenths of an inch in width along the entire length of the strip of boxing wax.

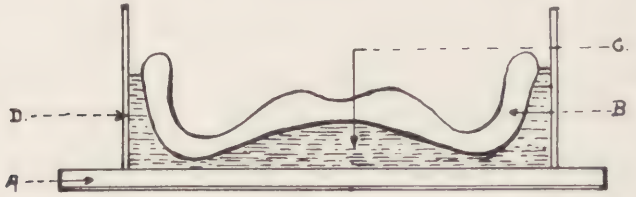


Fig. 1

Boxing of upper impression by a method not requiring heat: (A) Board. (B) The impression. (C) The moldine or clay support which attaches the impression to the board. (D) The sheet-lead or tin box.

(2) Seal this strip around the outer edges of the impression about one-eighth of an inch away from the crest of the impression's rim, and across the posterior border. Care should be exercised to prevent the wax from covering any portion of the impression.

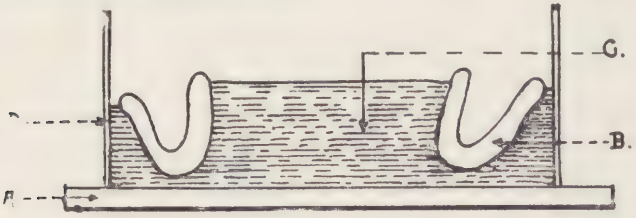


Fig. 2

Boxing of a lower impression: (A) Board. (B) Impression. (C) Clay, moldine or plaster support. (D) Sheet-lead or tin box.

(3) Mold the balance of the boxing wax to the outer border of the impression. With a warm spatula, seal the wax to the impression and along the edges of the boxing wax itself. Before sealing it is necessary to make certain that the top of the wax is not too high from the top of the impression, as this will create needless bulk in the cast; 1/3 inch is sufficient. See Fig. 1.

(4) The technique for lower impressions is exactly the same, with the exception of one step. In the lower it is necessary to apply a small piece of moldine or wax in the space that is occupied by the tongue. After this has been done, the case is boxed, as described above. See Fig. 2.

6. *Pouring of Casts*

This consists of transforming a negative impression of the dental arch into a positive reproduction of the same arch.

(1) After the plaster impression has been shellacked, varnished, and boxed; it should be immersed in water for ten minutes prior to pouring the cast. This is to allow the plaster to absorb a certain amount of water which will make the later separation much easier, and also will prevent a chalky cast.

(2) Remove impression from water and dry off all excess moisture.

(3) The casts must be made of a material of sufficient strength to withstand usage during the construction of the denture. It must withstand the pressure and temperature changes during vulcanization. It must not set too quickly as sufficient time is needed for manipulation, and, when setting, it should not expand or contract. Such a material is quick setting stone. As stone requires less water for mixing than does ordinary plaster, the correct proportion is approximately one part of water to three parts of stone by weight. This varies slightly according to the manufacturer, and his directions should be followed.

(4) Place the correct proportions of stone and water in a clean plaster bowl. Tap the bowl gently against the bench so that all air bubbles will be expelled. Leave sufficient time for the stone to absorb the water, as this will aid in the spatulation.

(5) Hold the bowl in one hand, and, with a plaster spatula, mix the stone with a cutting motion until it assumes a putty-like consistency. Never whip the stone as this will incorporate air into the mix. *Excessive spatulation* after a putty-like consistency has been secured will *reduce working time*, which condition must be guarded against.

(6) Never add water to a mix after spatulation in order to make it thinner. If such is done, crystallization which already has begun will be broken up resulting in a weak cast. Place a small portion of this stone in the rear of the impression, which is held in the hand. Gently jar it against the bench until the mix covers the tissue surface of the impression with a thin layer of stone.

(7) Continue adding the stone and allow each addition to settle in the impression before the next is deposited. Continue adding the stone until the impression is completely filled. Wait until the mix sets before proceeding.

(8) Remove boxing wax and score the top of the cast with a sharp knife to facilitate attachment to plaster when mounting on the articulator.

7. *Separation of Casts*

(1) With a sharp knife, very carefully scrape off the impression plaster until the brown color of the staining material becomes visible. This will weaken the impression so that it will be easy to remove without injuring the cast.

(2) Insert the sharp point of a knife in the line of fracture and apply slight pressure away from the teeth and thin parts of the cast. It is best to remove the plaster from around the teeth and undercuts before removing that from around the tissue surfaces. Great care must be taken in this step to prevent the breaking of teeth on the model.

(3) Remove any adhering separating media from the casts with cotton and alcohol.

(4) All rough edges and overhanging margins are removed with knife, file, or sandpaper and the casts trimmed and shaped as desired.

Section IV

Modeling Compound Impressions

8. *General*

A large percentage of the impressions that a dental technician must work with, is taken in impression compound. It may be white, black, red, or brown in color. The boxing of the com-

pound impression will require more care than those made from plaster. Whereas plaster that has hardened or set is unaffected by the application of hot wax in the boxing process, the compound will absorb some of the latent heat from the wax and soften sufficiently to distort it under hand manipulation, thus ruining the impression. Therefore, it must be boxed by a method that does not require heat. A simple technique is as follows:

9. *Boxing*

(1) Place the impression on some moldine or art clay which is molded to give evenly distributed support to the impression. This material is carried around the labial and buccal flanges of the impression to within one-eighth of an inch from the crest of the impression and its posterior border. The sides should be perpendicular. A piece of tin or lead sheet is conformed to the periphery of the impression and held secure by elastic bands. The casts may then be poured without danger of distortion. See Fig. 1.

(2) The method of handling the mandibular or lower impression is similar but the tongue area space of the lower requires a different treatment. The impression is seated on some moldine or art clay which is carried around the outside flanges as in the maxillary impression. Then the clay or moldine is carried into the tongue area space, filling it up to within one-eighth of an inch from the crest of the lingual flanges. A strip of tin or lead sheet is then carried around the circumference of the impression, as before, and held with elastic bands. The cast is then poured. If it is impossible to obtain the moldine used in this technique, ordinary plaster may be used in its place. It is a little harder to manipulate but will serve the same purpose. See Fig. 2.

(3) The modeling compound impressions do not need a staining and separating media unless a plaster wash has been used. This consists of a compound impression with a very thin layer of plaster over the entire tissue surface. In an impression of this type it is necessary to apply a light coat of sandarac varnish to the surface of the plaster so that

the casts may be more readily separated from the impression. A staining coat of shellac is unnecessary.

10. *Separation of Cast*

(1) In the removal of the compound impression from the cast, it is necessary to apply sufficient heat to return the compound to a soft or plastic state. This is accomplished by immersing the impression in warm water for a sufficient length of time to allow the entire thickness of the compound to become soft. If the water is too hot, the compound will become sticky and will adhere to the cast.

(2) Insert a knife blade under the edge of the impression and gently tease the compound away from the model. If it is sufficiently plastic, it should come away very easily. If it is too hard, there is danger of breaking the model. Take a small section at a time and then return the impression to the warm water for additional heating. In this way gradually remove the entire impression from the cast.

(3) The cast is then trimmed and shaped as usual.

Section V

Hydro-colloid Impressions

11. *General*

The third type of impression material that is commonly used is the hydro-colloid. It possesses unusual plasticity, some elasticity, and slight compressibility. The impression can be removed from undercuts without distortion and gives the finest detail. Casts are obtained without the use of separating media and without the danger of injury or breakage incident to the removal of the impression compound. Duplicate casts may be obtained by the careful removal of the model from the impression and repouring the impression or by making a second impression of the cast. This material is generally used in the making of impressions for partial dentures, although it may be used in conjunction with modeling compound for full denture cases. In either case, it is treated the same by the dental technician. The cast must be poured immediately after the impression is taken, otherwise the material will dry out and distort the impression. If this is impossible, it may be kept in cold water for a short time and then poured.

Section VI

Construction of Full and Partial Vulcanite Dentures

12. *Relief Areas*

The mucous membrane covering the bony tissues of the mouth is not of uniform thickness over the entire surface. There are areas where the membrane is very thin and the bone is quite prominent. This is especially true along the median raphe of the palate and the crest of the ridge. There are other areas of the mouth that have an abundance of connective tissue overlying the bone, examples of which are the tissue bearing areas of the palate and the slopes of the ridge. In constructing a denture it is necessary to relieve these hard areas so that the soft tissues overlying them will not be compressed when the denture is worn, and, at the same time, allow the tissue bearing areas to be evenly compressed. In addition to these bony areas, it is sometimes necessary to relieve pressure on nerves and blood vessels, especially where they come through the bony openings.

Relief areas may be prepared in two ways:

(1) The dental officer may prepare the areas to be relieved in the impression before the cast is made, or

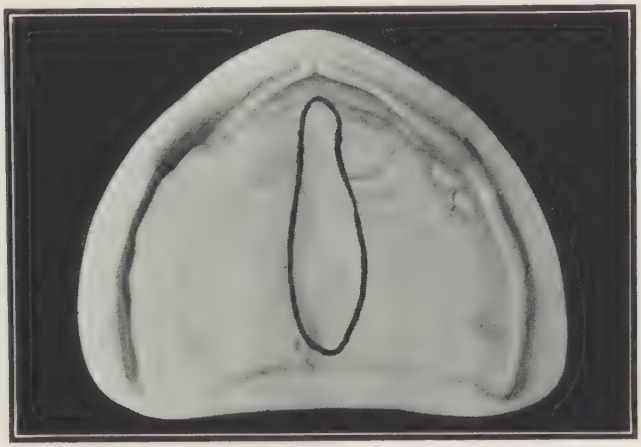


Fig. 3

Showing area to be relieved on upper model.

(2) The dental technician may prepare the areas indicated by the dental officer to be relieved, by burnishing on the cast, one or more layers of #40, #50 or #60 tinfoil, which has

been cut to fit the area for that particular case. As there can be no standard size and shape, the tinfoil must be cut for each case. The hardest areas are covered most thickly, but the thickness of the relief area should never be carried to the extent of creating a suction chamber, as in time this space would fill with hypertrophied tissue, thus defeating the purpose for which it was made. If tinfoil is unavailable, two or three layers of lead foil from x-ray films may be used in the same manner. See Fig. 3.

13. *Trial Denture Base*

Since a denture must fit the mouth accurately, it is first made on a trial base, such as wax, or other material which can be easily molded. This material should be of sufficient strength to hold its shape while the denture is tried in the mouth. Baseplate is preferable to wax as a trial denture base, however, because it holds its shape better and is not easily distorted by the temperature of the mouth.

Procedure of adapting baseplate to cast

(1) Pass the baseplate through the flame several times until it shows signs of wilting. Do not heat it too much as this will melt or burn the material. Fig. 4.

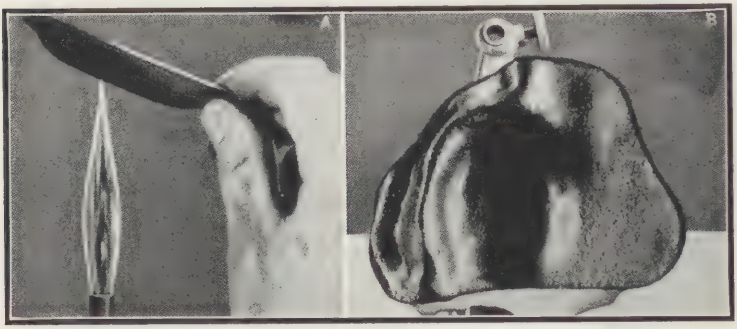


Fig. 4 Fig. 5

(2) Place the softened baseplate over the upper cast and adapt the palatal portion closely to the cast by pressing lightly with the fingers. Reheat the baseplate when necessary and continue adapting it over the alveolar border and over the buccal and labial surfaces. Fig. 5.

(3) Avoid buckling or creasing of the baseplate.

(4) Heat the partially adapted baseplate; and, using plate shears, trim away the surplus extending beyond the outer edges of the extension on the cast made by the carding wax rim in the boxing process. This is illustrated by *c-c-c* in Fig. 6.

Fig. 6

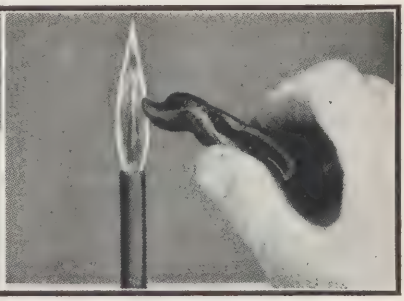


Fig. 7

(5) Heat the baseplate which rests on the extension of the cast material by passing it once through the flame and folding the heated portion upon the buccal and labial surfaces by pressure, as shown in Fig. 8, and continue to the finished form, shown on the right side in Fig. 9. The folded portion is not heated enough to fuse with the baseplate against which it is folded. Fold the extension across the

Fig. 8

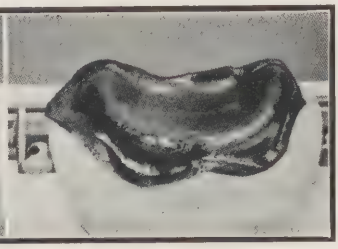


Fig. 9

heel in the same manner. The margins thus shaped must conform to the muscle trim margins of the impression and constitute a valuable reenforcement of the baseplate.

(6) Chill the baseplate with cold water and then carefully remove from the cast.

(7) In lower casts adapt the trial baseplate material over the highest part of the alveolar ridge in the anterior region of the cast and work backwards towards the heels. Treat the lingual, buccal, and labial margins of the lower baseplate the same as the upper.

(8) If the trial baseplate should be broken, it may be repaired by placing the broken pieces on the cast with the edges together and fusing with a hot wax spatula. Melt some of the baseplate material in a flame and drop it over the break. Smooth the surface.

(9) In partial cases, after adapting the baseplate to the palate and alveolar ridges, heat the material in the region of the plaster teeth and remove with a hot spatula or shears. This material should be removed to within one thirty-second of an inch from the gum margins of the plaster teeth, and the edges of the baseplate smoothed with a file.

(10) In partial lowers, it is necessary to reenforce the baseplate extending about the teeth by imbedding a hot wire or paper clip in the baseplate and smoothing the surface with a hot spatula.

14. *Biteplates*

The mandible or lower jaw, is movable, and is attached to the skull by two movable joints, giving it a hinge-like motion. However, this is not a fixed motion as the jaw may also be moved in other directions within limits. In a mouth with natural teeth in place, the occlusal surfaces of these teeth act as guides which permit the jaws to come together in a rest or centric position. When the teeth are gone this relationship is missing. Therefore it is necessary to construct *biteplates* which will help the dental officer in reestablishing this relationship. Since the dental technician does not see the patient, he can only approximate the required size and shape of the bite plates.

(1) Mark on the cast, in a place where it can be seen, with the trial denture base in place, a line designating the crest of the alveolar ridge. This is for future reference in setting up the artificial teeth.

(2) Soften a sheet of basewax, by passing it over a flame several times, and fold it along its lesser length into a tight roll.

(3) Bend the wax roll to the approximate shape of the alveolar ridge of the cast.

(4) Replace the trial baseplate on the cast and attach the roll of wax, sealing it with a hot spatula.

(5) Using a template, or any flat surface, press the wax to the desired height. This is usually about 10 to 13 millimeters in height from the anterior portion of the alveolar ridge, and less in the molar region.

Fig. 10

(6) With a knife and a hot spatula, trim the sides of the baseplate to a width of not more than 8 millimeters.

(7) Add melted wax where necessary to fill in spaces between the wax roll and the baseplate on the buccal, labial and lingual surfaces.

(8) In partial cases be sure that the biteplate does not interfere with the teeth on the cast and cut the wax roll to fit the alveolar ridge where the teeth are missing, extending the wax about one-sixteenth of an inch above the teeth of the cast but not covering the teeth.

(9) Square up the sides and angles of the biteplate, making certain that it conforms to the cast and that it is directly over the crest of the alveolar ridge.

(10) Polish the biteplate with wet cotton. See Fig. 10.

15. *Mounting Casts on Articulator*

The cast or casts, with the biteplates constructed, are returned to the dental officer, who records the relationship of the patient's lower jaw to the upper jaw. This is known as *"taking the bite."* This established, the casts and biteplates come back to the dental technician ready to be placed on the articulator. The articulator used in the Army dental service is known as the Gysi Simplex Articulator, which simulates the movements of the jaw and has the plane of the condyle paths set at 30 degrees.

Procedure in Mounting Casts.

(1) Attach the biteplates to the casts with wax at several points.

(2) Place the casts in water until all bubbling has ceased.

(3) Place the incisor guide pin in the sleeve of the upper extension arm, keeping the top of the pin level with the top of the sleeve.

Fig. 11

(4) Place the incisal guide on the pin, with the set-screw in the depression of the pin and the point directed backward to the median line.

(5) Extend the median line mark on the front of the upper cast or bite rim, vertically upward to the top of the cast. Make a similar vertical mark on the rear of the cast, starting from the median line of the palate. Draw a straight line across the cast connecting these two lines.

(6) Place an elastic band about the set-screw on the incisor guide point and in the notches on the outer sides of the vertical part of the frame. This line, as given by the elastic band, will establish the approximate occlusal plane.

(7) Place three small pieces of wax or moldine in a tripod arrangement on the lower extension arm, and force the lower cast down over these pieces until the occlusal plane of the biteplate is level with the elastic band, and the median line of the biteplate touches the tip of the incisor guide. Adjust the casts so that the median line of the upper cast is directly below the median line of the upper extension arm.

(8) Attach the upper cast to the upper extension arm with plaster and allow to set, then invert the articulator and attach the lower cast to the lower extension arm in the same manner.

(9) Allow plaster to set and trim off all excess plaster. See Fig. 11.

(10) Carefully separate the biteplates and remove the biteplates from the casts.

16. *Selecting Artificial Teeth*

Before taking up the technique of setting the teeth, to which stage the case has been brought, we will consider the question of selection of artificial teeth, of vital importance to both the efficiency and appearance of artificial dentures. In selecting artificial teeth, the two principal requirements to be considered are appearance, which includes form, proportion and shade, and mechanics, such as the length of bite and ridgelap necessary to the proper adaptation of the teeth to the ridges. These two factors are so often dependent upon each other that any apparent antagonism between them calls for judgment in making the necessary compromise. It may be stated, as a safe rule to follow, that whenever the mechanical requirements interfere with the final appearance, the mechanics should be sacrificed as much as possible. While this may be questioned by some authorities, experience proves that appearance is the most important factor with the patient and many dentures which are mechanically perfect are unsatisfactory because they do not "look right."

17. *Requirements of Tooth Forms*

Briefly, all teeth must correspond or harmonize in form and contour with the form and contour of the face which "frames" them in order to blend into the individuality of the person wearing them and insure the most pleasing effect. There are three typal forms of faces—Square, Tapering and Ovoid. These forms are further modified by an admixture of the elements of two or more of these typal forms. There are, likewise, the same typal forms of teeth. Whenever the face forms and tooth forms correspond and harmonize, the effect is fine. To the extent that the teeth differ in form with faces, there is a disharmony which is displeasing in degree. For instance: when square teeth are framed in an ovoid face, the effect is unpleasant and the teeth are conspicuous, whereas when ovoid teeth are framed with an ovoid face the effect is pleasing in that the teeth do not seem to obtrude—they "belong" with the face. Tooth shade, form, and approximate size are always selected by the dental officer to conform with the requirement of the individual case, and such instructions should be followed as closely as mechanically possible. In the selection of teeth for partial cases the teeth should be of such size, that after they have been contoured to the adjoining clasps or teeth they will completely fill the edentulous area.

18. *Arranging the Upper Anteriors*

Procedure.

Remove the upper bow from the articulator. Procure an occlusal plane or a flat piece of wood or aluminum 2½ inches square, and use it as shown in the illustrations to take the place of the occlusal surface of the lower bite rim. See Fig. 12.

Before waxing the upper central in place, try for mechanical suitability. If necessary carve away the baseplate under the tooth or grind the ridgelap, or do both, so that the tooth will not rest directly against the cast. The long axis of the upper central should be vertical when seen from the front and inclined downward and forward when seen from the side, as in "B" and "C", Fig. 12. The incisal edge is in contact with the occlusal plane. The upper centrals are not set at right angles to the median line, but the distal angles are inclined slightly backward and begin the curvature of the tooth row to follow the contour of the bite rim.

Cut a space through the upper bite rim for the upper lateral and try it in place as the central was tried. Set it so that the incisal edge is about ¾ of a millimeter above the level of the oc-

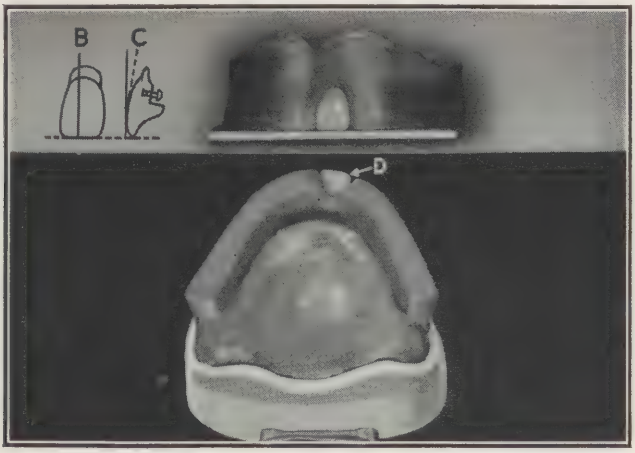


Fig. 12

clusal plane and so that the long axis is inclined as in "B" and "C", Fig. 13. This downward and forward inclination of the vertical

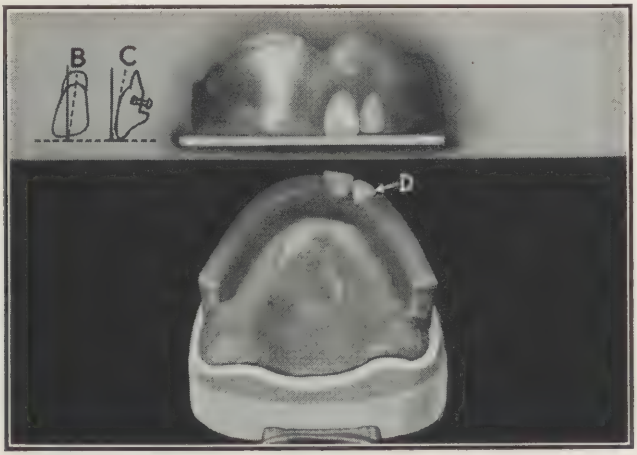


Fig. 13

axis of the upper laterals results in making the neck of this tooth less prominent than that of the upper central. This depression will be found very valuable when giving expression to the teeth.

The incisal edges of the laterals are set to maintain the curvature established by the incisal edge of the upper bite rim, as shown at "D".

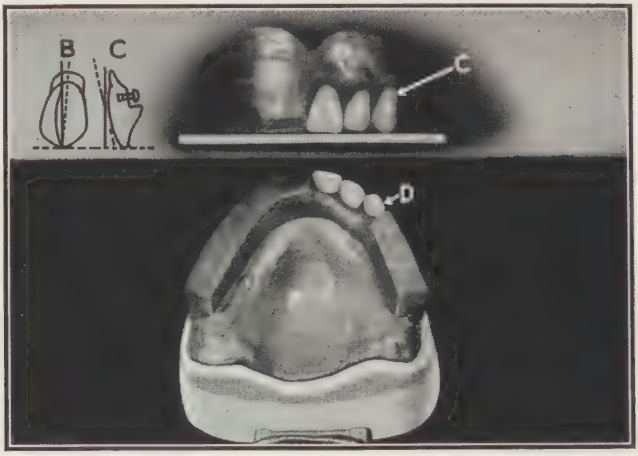


Fig. 14

Cut a space clear through the upper bit rim to receive the upper cuspid. Try the tooth for length as the central and lateral were tried. Set the tooth so that its tip just touches the occlusal plane

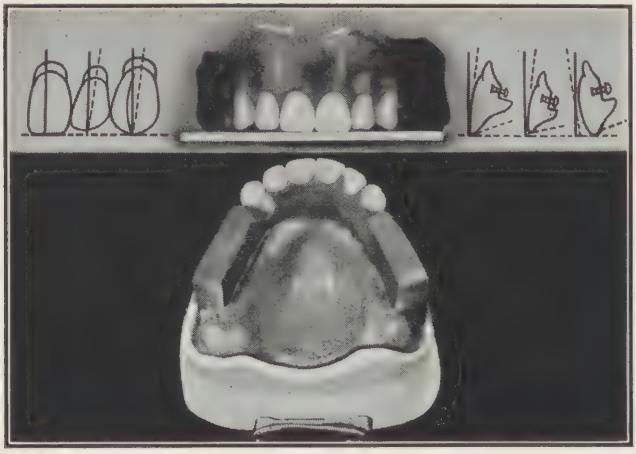


Fig. 15

and its long axis is inclined as shown in "B" and "C" and at the edge of the tooth continue the curve of the bite rim as shown at "D," Fig. 14. The labial ridge of the cuspid is properly the divid-

ing line between the labial and buccal sections of the ridge. The labial surface mesial to the ridge faces the lip and maintains the general curvature established by the central and lateral. The surface distal to this ridge faces the cheek and begins the curvature characteristic of the bicuspids and molars. The effect of setting the cuspids in this position is to carry the distal angles farther inward toward the median line. When the cuspids are set in this way, only the mesial aspect can be seen from the front. This permits the use of teeth large enough for the mouth, without their appearing too large. The esthetic effect of this arrangement is greatly enhanced by the natural shading of the teeth in the set and gives prominence to the neck or cervical third of both cuspids.

When the central, lateral and cuspid of one side have been set, set the central, lateral and cuspid on the other side in the same manner, Fig. 15.

19. *Arranging the Upper Posteriors*

Having determined the type of arch, the upper bicuspids and molars are set with their vertical axes in the lines shown in Fig. 16.

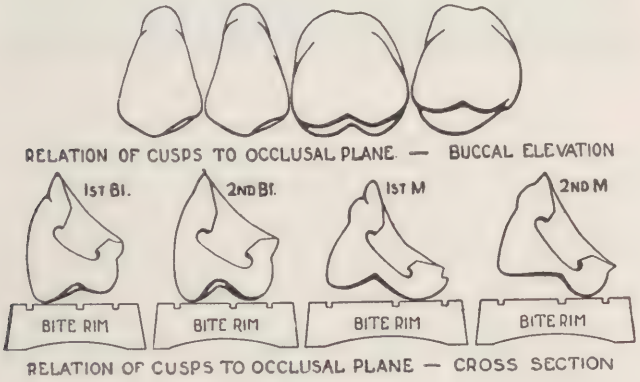


Fig. 16

The buccal cusp of the upper first bicuspid touches the occlusal surface of the lower trial plate, but the lingual cusp does not quite touch. Both cusps of the upper second bicuspids touch the wax. See Fig. 17. The buccal cusps of the upper first molar are elevated about a millimeter above the wax to begin the compensating curve formed by the buccal cusp of both upper molars.

The lingual cusps of the second molars are in contact with the opposing trial plate, but the buccal cusps are elevated about 2 millimeters above the wax. They continue the compensating curve which the buccal cusps of the first molars began.

It is necessary, while establishing these relations, to secure such positions of the teeth over the ridge as to give the dentures maxi-

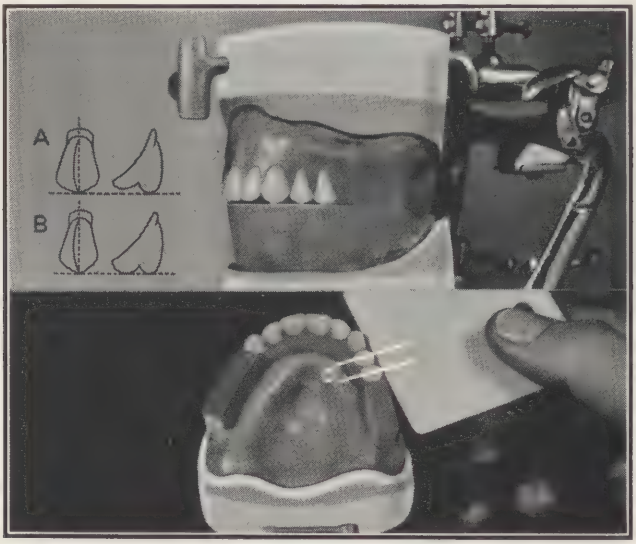


Fig. 17

mum stability and efficiency. Fit each posterior tooth to its position before waxing it in place, as the anteriors were fitted. Make sure that each tooth is short enough so that there is a free space of at least a millimeter between it and the baseplate. Cut a strip one-half inch wide along the side of a sheet of baseplate wax and soften one end of it in the flame. Detach a small portion and form it into a cone. Soften the end of the cone in the flame and force it about the pins or into the recess in the diatoric tooth. Using the tooth as a handle, soften the other end of the cone and press it upon the ridge with the tooth in approximately the correct position. Close the articulator so that the incisor guide pin comes into contact with the incisor guide incline. Adjust the teeth so that the center of the longitudinal groove is over the front-to-back line on the occlusal surface of the lower bite rim. The buccal cusp of the upper first bicuspid should touch the occlusal surface

of the lower bite; the lingual cusp should be raised about one-half millimeter above that rim. When the tooth is first placed, the long axis of the tooth, as seen from the buccal, should be vertical, as shown at "A" in Fig. 17. This may be slightly modified in establishing articulation. The second bicuspid should be set like the first except that both cusps touch the opposing bite rim, as shown at "B" in Fig. 17. Rotate both bicuspids upon their long

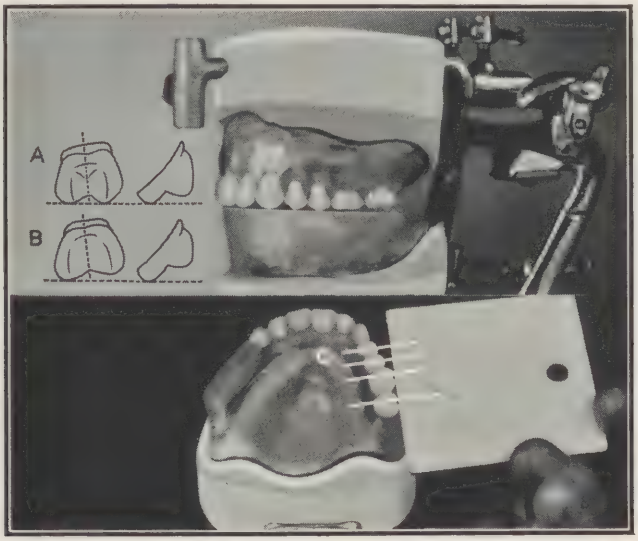


Fig. 18

axis so that the occlusal surfaces are inclined as shown by the lines in "C", Fig. 17. With the straightedge of the occlusal plane, test the position of the buccal surface of the bicuspid in relation to the cuspids. When these teeth are in proper relation for the average case, the straightedge should touch the buccal surfaces of all three teeth.

Attach the upper first molar to the ridge as the bicuspids were attached. The long axis of this tooth, when seen from the buccal, is inclined downward and backward as shown at "A", Fig. 18. Only the mesio-lingual cusp of this tooth should touch the occlusal surface of the opposing bite, the disto-lingual cusp being slightly raised and the buccal cusp being raised about three-quarters of a millimeter out of contact, as shown in "A", Fig. 18. This arrangement produces the average compensating curve. When a greater curvature is required, the distal cusps should be elevated more.

The tooth should be rotated upon its long axis as shown at "C" in Fig. 18.

The upper second molar is now placed in position, with its lingual cusps lightly touching the occlusal plane and the buccal cusp raised about one and one-half millimeters out of contact as shown in "B" Fig. 18. If a greater curvature is desired, the lingual cusp should be elevated out of contact and the buccal

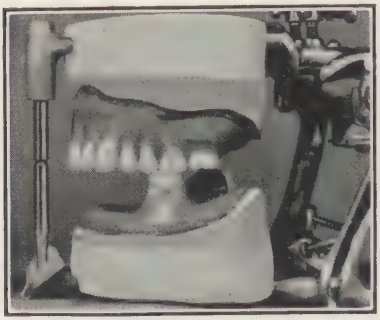


Fig. 19

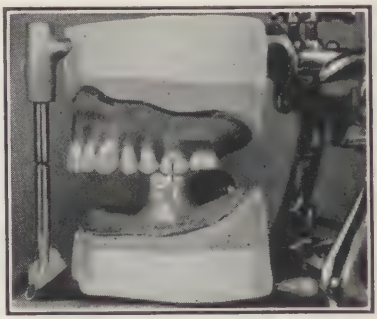


Fig. 20

cusp elevated in a corresponding degree. The long axis, seen from the buccal, is inclined downward and backward more than was the first molar.

20. *Arranging the Lower First Molar*

Apply a cone of wax to a lower first molar. Open the articulator and attach the molar to the ridge in approximately the cor-

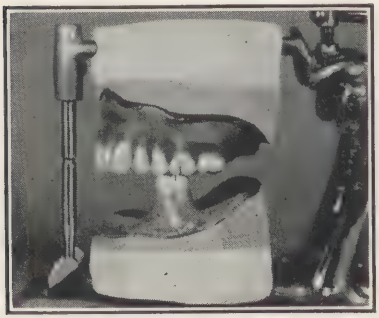


Fig. 21

Fig. 22

rect position, but too high. Close the articulator, forcing the molar toward the ridge. Guide it to correct occlusal relations

with the uppers as in Fig. 19. Wax the molar firmly in position. Move the articulator so as to throw this molar into working bite with the uppers, as in Fig. 20. A black line has been drawn along the buccal ridge of the middle cusp of the lower molar. It should be continuous with the black line in the buccal groove of the upper molar. The break in the line in Fig. 21 shows that the lower molar is too far forward for articulation. Figs. 19 and 21

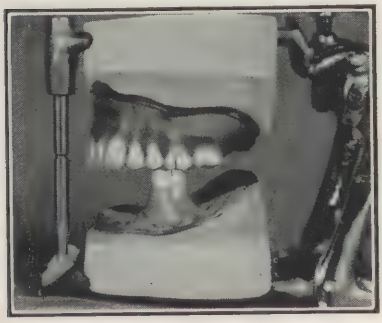


Fig. 23

Fig. 24

show that teeth may be in good position for occlusion without being in position to articulate. In Fig. 20 the lower molar has been moved backward so that the black line is continuous with the line on the upper, in working bite, but the buccal cusps do not interdigitate with the upper cusps. Errors of this kind can usually be corrected by depressing the buccal cusps of the upper molar, but in this case the steep descending inclination of the condyle path, with the slight lateral inclination, necessitated grinding the teeth to a deeper bite. With a fine-grit, inverted cone stone the mesial marginal ridge of the upper molar and the distal marginal ridge of the lower molar were ground until they could be properly interdigitated. In Fig. 22 the molars are shown in working bite after deepening the sulci by grinding has been completed and the lower molar reset to proper contact with the upper. The space between the upper second bicuspid and the lower molar in Fig. 20 has been decreased by deepening the bite of the molars and raising the lower molar. The lower first molar in Fig. 23 is in the same position on the ridge that it occupied in Fig. 22, but the articulator has been moved so as to throw this side into balancing relation. The triangular ridge of the mesio-lingual cusp of the upper molar should slide in the disto-buccal groove of the lower molar, but cusp and groove are separated

by a slight space. A defect of this kind can usually be corrected by depressing the lingual cusp of the upper molar until contact is established and waxing the upper firmly in that position. It may be necessary to rotate either the upper or the lower on its vertical axis until the cusp works smoothly in the groove. Examine the working bite articulation from the lingual, as shown in Fig. 25.

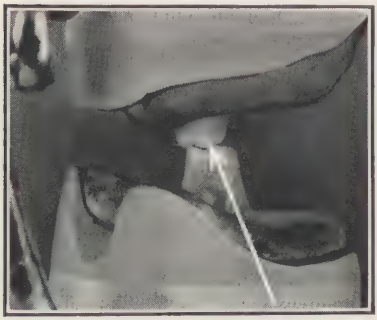


Fig. 25

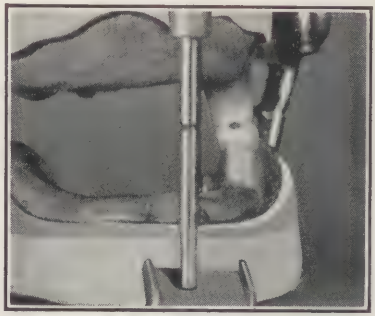


Fig. 26

The slight prominence of the mesio-lingual cusp of the lower molar, indicated by the arrow, prevents correct relations in the working bite. Grind this away with the inverted cone stone, being careful to maintain the original inclination of the cusp planes. Do not grind a flat surface on the tip of the cusp. The upper and lower molars, in occlusion, should mesh as in Fig. 24.

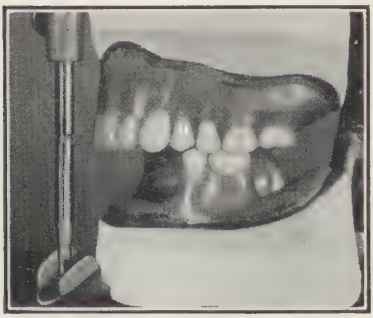


Fig. 27

Fig. 28

The buccal cusp of the lower should fill the V-shaped longitudinal groove between the lingual and buccal cusps of the upper. The lingually inclined plane of the lower buccal cusp should be in contact with the buccally inclined plane of the lingual cusp. Fig.

26 shows the relation of the upper and lower molars in working bite.

21. *Arranging the Lower Second Bicuspid*

After completing the articulation of the upper and lower molars for the case here illustrated, the distal marginal ridge of the upper

Fig. 29

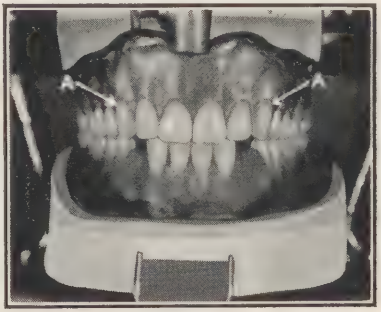


Fig. 30

second bicuspid was ground in the manner described for the first molars until the buccal cusp of the bicuspid could be brought down in contact with the buccal cusp of the lower molar when in working-bite relation. The tooth was then examined from the

Fig. 31

lingual and adjusted to mesh properly with the lower molar in working bite. Attach a cone of wax to the neck of the lower second bicuspid and place it on the ridge in the manner described for the molar and with a spatula press it into approximate occlusion with the upper second bicuspid. Move the articulator so as to test the articulation in working bite, which is shown in Fig. 28.

The space between the lower second bicuspid and the molar in Fig. 28 will exist whenever the conditions of the case necessitate a compensating curve of more than average steepness. The existence of such spaces compensates, in part, for the shrinkage of rubber in vulcanizing and reduces the liability of error from the teeth being forced into improper contact through that shrink-

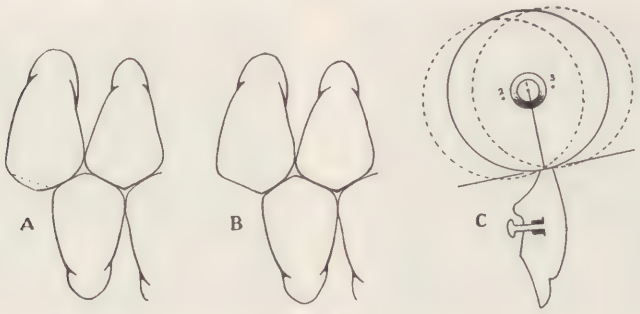


Fig. 32

Mesial facet of upper cuspids (A) before grinding to correct relation in working bite, (B) after grinding, (C) relation of center of stone to the long axis of cuspid for grinding bucco-lingual pitch on the facet. Solid circle, center 1, shows correct position; dotted circles, centers 2 and 3, show incorrect positions.

age. Occlude and articulate the lower second molar as shown in Fig. 29. Set the lower second bicuspid for occlusion and then for articulation by the methods described. Arrange the lower molars and the second bicuspid of the opposite side, using the same technique. Set the lower anteriors to approximate positions to determine whether they meet the requirements of the case as to width and length. If insufficient space exists between the lower bicuspid to permit setting the lower anteriors because of irregularities in the alignment of the upper anteriors, additional space may be made by grinding the distal side of the lower cuspids or the mesial side of the lower first molar.

If sufficient space cannot be provided by such grinding, select lower anteriors of the next smaller size in the same form.

22. *Arranging the Lower Anteriors*

The roots of the lower centrals and laterals are parallel, but those of the lower cuspids diverge strongly as will be pointed out later when the lower cuspid is articulated. The lower centrals slope strongly outward from the neck to the incisal edge. This

prevents the overfullness of the gums so common to lower dentures. The lower laterals slope outward very much less than do the centrals. This is shown in Fig. 34.

23. *Arranging the Cuspids*

The upper lateral adjoining the cuspid should be removed from its place without heating the wax, so that it can be easily replaced. This will facilitate articulating the lower cuspid.

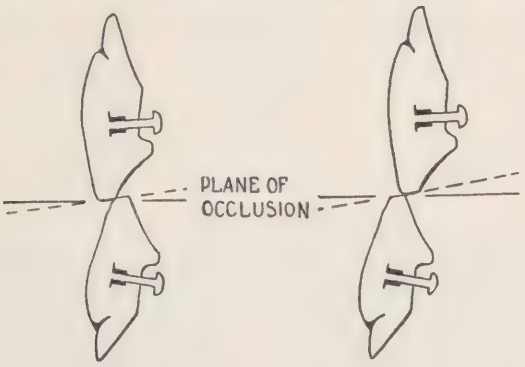


Fig. 33

Cuspids in rest and beginning of working bite relation, showing dotted line indicating proper bucco-lingual inclination for these cusp facets.

Set the lower cuspid in position and grind the mesio-distal inclination of the distal half of the cutting edge to be parallel to the inclination of the cutting edge of the mesial half of the upper cuspid as in Fig. 31. The facet on the mesial slope on the upper cuspid is to be ground to the lingual inclination shown by the outline in Fig. 32, so that a straightedge placed in contact with the facet will touch the wax at the mesio-lingual cusp of the first molar. Grind the facet on the distal slope of the cutting edge of the lower cuspid to a labial inclination which is the complement of the lingual slope of the upper cuspid with which it occludes as shown in Fig. 33. The inclination of the long axis of the lower cuspid is also shown in Fig. 33. In the left part of Fig. 33 the complementary inclination of the facets on the cutting edges of the cuspids is shown with the cuspids in occlusion. In the right part of the figure, the cuspids are shown in articulation with the lower about to begin the return from an extreme lateral excursion. The complementary inclinations of the facets make it possible for the cuspids to remain in contact throughout these

movements. This form of articulation by the cuspids is very important in maintaining the stability of the dentures and in protecting the upper laterals from breakage. If the lower cuspids are set to too deep an under bite, the dentures are almost sure to be tipped out of position by improper cuspid contacts; the force of the closure will be brought upon the thin-edged laterals which

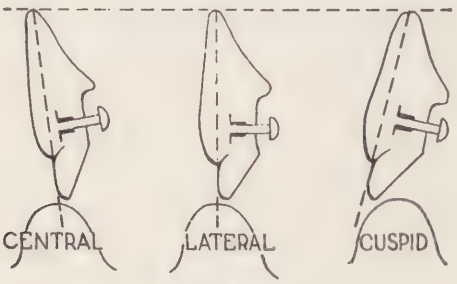


Fig. 34

Relation of lower cuspids and incisors to ridge, and average inclination for long axes.

are not fitted to stand it, and they will be broken from the plate. This form of improper contact is very apt to occur in finished dentures unless guarded against and is disastrous.

Replace the upper lateral but do not attach it. Move the articulator to produce the working and balancing relations and grind the mesial edge of the lower cuspid so that it clears the slope on the distal angle of the upper lateral. The upper laterals and the lower cuspids should not come into contact in any movement of the jaw. The facet on the cutting edge of the upper lateral should incline upward and backward more than that on the edge of the cuspid. When this facet has been ground, articulate the lower lateral with it. Do not grind facets on the cutting edges of the lower incisors. Grind facets on the edges of the upper centrals and articulate the lower centrals with them. The lower incisors should be set with the necks directly over the ridge and the long axis of the teeth should be inclined as is shown in Fig. 34.

24. *Arranging the Lower First Bicuspid*

The lower first bicuspid is the last tooth to be placed. It is articulated in the same manner as the second bicuspid. If the indicated space is not adequate to accommodate the lower first bicuspid, the mediodistal width of the tooth is reduced by grind-

ing. Never crowd the lower anterior teeth out of position and off the ridge in order to place this tooth. Fig. 35 shows the tooth in position.

25. *The Incising Bite*

Before the teeth are tried in the mouth, hold the articulator in the incising position and slightly alter the arrangement of the incisors and cuspids if necessary so that they will come into proper contact. The upper centrals should touch the lower centrals. The upper laterals may, in certain arrangements, touch the lower laterals, but they should not touch the lower cuspids. Most instances of broken laterals, not due to careless handling, have been found to be due to a cuspid striking the lateral in the incising or the working bite. The lower cuspids should touch the up-

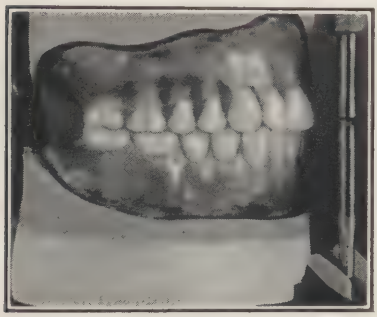


Fig. 35

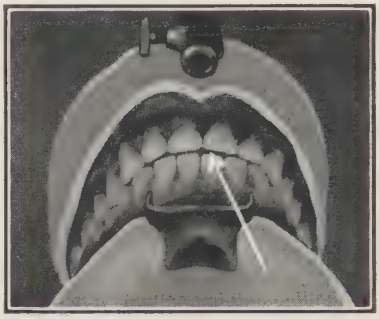


Fig. 36

per cuspids but not the upper laterals in masticating movements. Fig. 36 shows the average over-jet of the upper anteriors over the lower teeth.

When the lower is in central occlusion the lower incisors and possibly the lower cuspids should not be in contact. The lower incisors should not be allowed to support the dentures in lateral protrusive movements but should share this strain with the bicuspids and the cuspids. The pressure on the cuspids should be heavier than on the upper laterals or the lower incisors. The danger of breaking the incisors during mastication will be eliminated if the foregoing instructions are observed and the errors seen in the finished denture are corrected by grinding with a stone while the dentures are examined for these contacts in the mouth. The lower first bicuspid should be in contact with the

upper cuspid which acts as a protector for the upper lateral and prevents the incisors from receiving any excessive strain. The tip of the cusp of the lower second bicuspid may touch the tip of the upper first bicuspid cusp but this is not essential. The tip of the upper second bicuspid should come into contact with the mesio-buccal cusp of the lower first molar. The lingual cusps of the bicuspids and molars also come into contact in the incising-bite relation. Occasionally the lingual cusps will touch so heavily that the buccal cusps cannot come into contact. If any cusp rides so heavily on an opposing cusp as to prevent the teeth from coming into the proper relation with their antagonists, a little careful grinding will correct the trouble.

26. *The Balancing Bite*

The depth of this bite is the distance the lower teeth on the balancing side move vertically to maintain balancing relations between the dentures during articulation. It is much greater than the depth of the working bite, because the steep lingual inclines of the lower buccal cusps articulate with the steep inclines of the lingual cusps of the upper teeth, and because the lower cusps often travel directly across the steepest parts of the upper cusps instead of following the sulci.

27. *Central Dental Laboratory Assortment of New Trubyte Teeth*

The following charts give the assortment of teeth chosen for the Central Dental Laboratories for shades and moulds. The data given in the last four columns assist in choosing teeth and matching the lower anteriors and posteriors with the upper anteriors. The shades of the New Hue and the New Trubyte Teeth, as selected for Army use, are given below, with the corresponding shades for the Old Trubyte Teeth.

New Hue	New Trubyte	Old Trubyte
63	40	5
66	41	6
67	43	7
77	46	9
81	49	14
69	52	15
79	55	16
83	57	20

UPPER ANTERIORS 1 x 6 SQUARE TYPE

Mould No.	Width of Central mm.	Posteriors Required	Lower Anteriors Required
115	8.5	34M—31L	25
117	9.5	34L —35L	27
123	7.5	30L —29L	33
124	8.	32L —31L	34
126	9.	34L —33L	36
133s	7.5	30M—29M	43s
134	8.	32M—31M	44
135s	8.5	32L —31M	45s
136s	9.	34M—33M	46s
155	8.5	32M—31M	34

UPPER ANTERIORS 1 x 6 TAPERING TYPE

Mould No.	Width of Central mm.	Posteriors Required	Lower Anteriors Required
214	8.	32L —31L	34
217	9.5	34L —35L	27
222	7.	28S —29S	31
224	8.	30L —31M	33
225s	8.5	32L —31L	45s
225	8.5	32L —31L	34
226s	9.	34M—33L	46s
233	7.5	30M—29L	32
234	8.	32L —31L	34
235	8.5	34M—31L	35
244	8.	32L —31M	34
262	7.	28L —29L	22
263	7.5	30L —29L	23
264	8.	32L —31L	24
265	8.5	34L —31L	25
266	9.	34L —33L	26
267	9.5	34L —35L	27
275	8.5	32L —31M	45

UPPER ANTERIORS 1 x 6 OVOID TYPE

Mould No.	Width of Central mm.	Posteriors Required	Lower Anteriors Required
314	8.	32L —31L	24
315	8.5	32L —31L	25
317	9.5	34L —35L	27
324	8.	32L —31L	24
333	7.5	30L —29M	23
334	8.	32L —31M	24
335	8.5	34M—31L	25
346	9.	34L —33M	46

LOWER ANTERIORS 1 x 6

Moulds available:

22-23-24-25-26-27-31-32-33-34-35-36
43-43s-44-45-45s-46-46s.

UPPER POSTERIORS, REGULAR 1 x 8
LOWER POSTERIORS, REGULAR 1 x 8

Moulds available:

28S-28M-28L-30S-30M-30L-32S-32M-32L-34S-34M-34L-32X.

UPPER POSTERIORS, 20 DEGREE 1 x 8
LOWER POSTERIORS, 20 DEGREE 1 x 8

Moulds available:

29S-29M-29L-31S-31M-31L-33S-33M-33L-35L.

28. *Denture Waxing*

After the teeth are arranged, the technician proceeds with the carving of the wax so that he has an exact duplicate of the finished denture. By this method the wax denture may be placed in the mouth and checked for appearance and mechanical efficiency by the dental officer, and, if any changes are necessary, they can be made at this time.

Procedure

(1) Add melted wax to the case in deficient areas, especially along the buccal and labial surfaces of the denture. This

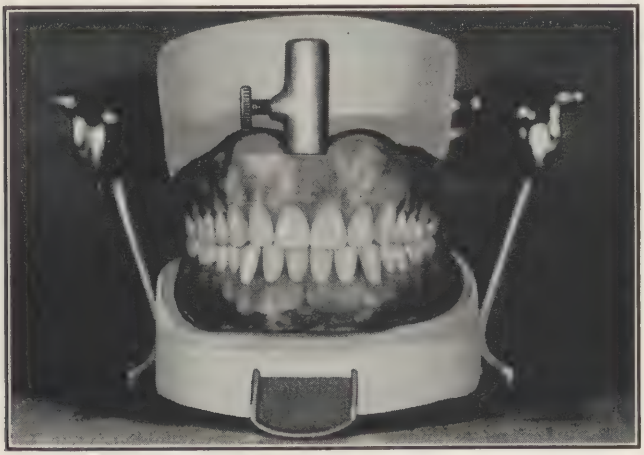


Fig. 37

will later be carved so as to simulate the irregularities of the gum caused by the roots of the natural teeth.

(2) With a knife, or wax spatula, festoon all teeth at right angles to the long axis of the teeth. This should be carried to the necks of the teeth on the buccal, labial, and lingual surfaces. Do not festoon too deeply in the interproximal spaces between the teeth.

(3) Smooth the entire surface of the wax by passing a flame quickly over the area. It may be further polished by rubbing with a piece of cotton while holding it under running cold water.

(4) The waxed denture is now ready for try-in. See Fig. 37.

29. *Denture Flasking (Full)*

This is the process by which the wax or trial denture is started on a new series of procedures, from which will emerge the finished denture. The denture base, after having been checked in the patient's mouth by the dental officer, is sealed to the cast and invested in a flask so as to retain the exact relationship of the teeth and preserve the space from which the wax will be eliminated so that it may be filled with dental rubber or some other material. The flasking process will maintain this space and relationship while the denture is being vulcanized or cured.

Procedure.

(1) Seal the waxed denture to the cast along its entire periphery and make sure that all the teeth are securely waxed in place.

(2) Remove the models from the articulator.

(3) Cut out the palate of the trial denture base and adapt one and one-half thicknesses of baseplate wax to the palate of the case.

(4) Place the cast in the lower part of the flask. Then place the upper or counterpart of the flask in position, making sure that there is sufficient room in the flask for the case. Place the cover on the flask, making certain that the teeth do not touch the top of the flask. At least one quarter inch of space should be maintained.

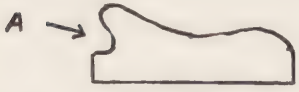


Fig. 38

Showing undercut (A) when cast is flasked level.

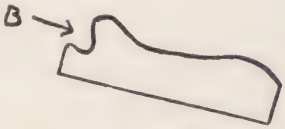


Fig. 39

Showing elimination of undercut (B) when cast is flasked at an angle.

(5) Remove the cast from the flask and immerse in cold water for a few minutes until all bubbling ceases.

(6) Make a plaster of paris mix, of a heavy creamy consistency, and fill the lower portion of the flask to about two-thirds of its capacity. If the plaster is too thin, it is difficult to control, and will extend upon the waxed surfaces.

(7) If no undercuts are present on the cast, settle it in the plaster mix so that the occlusal plane of the teeth will be parallel with the bottom of the flask. If undercuts are present, as they sometimes are around the anterior region or the heels, it is necessary to place the cast in the plaster at such an angle so as to compensate for the undercut. For instance, if the anterior ridge is undercut, it is necessary to raise the anterior portion of the cast above the level of the heels. See Figs. 38 and 39.

(8) Remove all excess plaster between the peripheral rim of the denture and the rim of the lower portion of the flask, smoothing the surface of the plaster.

(9) Allow plaster to set until hard and then apply a little petrolatum or green soap to the surface of the plaster to act as a separating medium.

(10) Set the upper portion of the flask in position.

(11) Make a plaster mix and fill the upper portion of the flask, pouring the plaster carefully, and gently jarring the case so as to prevent inclusion of air bubbles.

(12) Place the top of the flask in position and wipe off all excess plaster.

30. *Denture Flasking (Partial)*

(1) Holding of clasps and framework to models upon separation.

The first method to be described consists of flasking the denture similarly to that just described, but in addition, cutting of the remaining teeth from the cast to within one-sixteenth of an inch from the wax. This exposes all the clasps. When removing the plaster tooth from within a clasp, extreme caution should be exercised. It is often advisable to remove such teeth with a bur. After removal of the plaster tooth from the clasped area, any adjacent voids in the wax should be filled with wax. These clasps as well as any other metal parts such as lingual bars, etc, are then covered with plaster mix in the lower portion of the flask, leaving just the wax surfaces and artificial teeth exposed. From this point the flasking is carried out as given above. See Fig. 40.

(2) Removal of clasp and framework from the model upon separation.

Another method of flasking partial dentures is frequently used, especially in the acrylic resin cases that require tin foiling. It

Fig. 40

consists of cutting off all the teeth from the model to within one-sixteenth of an inch from the wax. The exposed clasps, bars, etc.

Fig. 41

are then incorporated into the upper portion of the flask instead of the lower. It is often advisable in the case of palatal and lingual bars to remove a portion of the cast from about the bar to insure their retention and more stable relationship when using

this method. When the plaster in the upper half has set, the wax eliminated and the flask opened as described in the next step; the clasps, etc., will be pulled away from the model, but still will maintain their correct relationship. See Fig. 41.

Either method of flasking may be used, depending upon the individual case under construction. In either method, prior to the pouring of the upper half of the flask, make doubly sure that all undercuts are eliminated in order to prevent fracture or irreparable damage to the models upon separation of the flask.

31. *Packing the Case*

The case is now ready to be packed with any material that has been selected. Dental rubber or vulcanite, and acrylic resin are the most satisfactory and the most commonly used. Therefore, we will deal only with these materials. All cases should be carefully packed with the right quantity of material. There is no reason for overpacking and thus inviting danger of breakage of the cast and the destruction of the occlusion of the teeth. The "dry" method of packing vulcanite cases is the most desirable.

(1) The pink gum rubber is cut into strips which are wide enough to cover the ridge lap of the teeth and extend to the border of the matrix. A narrow strip is then cut into small, triangular pieces which will fill the spaces between the teeth. The base rubber is cut into the desired-sized pieces for the lingual and hidden parts of the case. Pink rubber is used on the labial and buccal surfaces of the denture because it has a much more natural appearance. Base rubber is used on the palatal and hidden surfaces of the denture because it is much stronger and durable than the pink rubber.

(2) The lower part of the flask is placed in a heated oven, and warmed throughout, to a temperature of about 212 degrees. It is then removed from the oven and placed on a towel which will serve as a heat retainer during the packing process.

(3) Using suitable packing tools, carefully place the triangular pieces of rubber between the interproximal spaces of the teeth.

(4) Fold a strip of dark rubber about one-quarter inch wide along its greater length, and cut a piece long enough to fit

from the first-bicuspid region of one side to the first-bicuspid region of the other. Insert this piece of rubber under the pins of the anterior teeth.

(5) Pack the small square pieces of the dark rubber into each one of the diatoric openings of the posterior teeth. See Fig. 42.

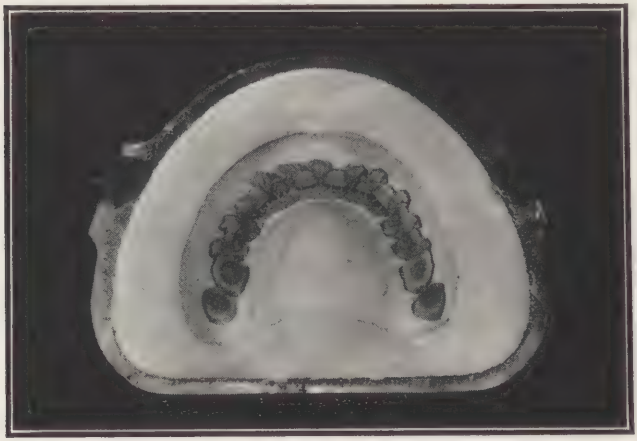


Fig. 42

(6) Place two strips of the pink rubber, about one-half inch in width, one over the other, and lay them over the triangular pieces and the edge of the teeth, along the buccal and labial surfaces, from the median line to the region of the second molar. Place two more strips of the pink rubber in identical positions on the other side. These pink strips should extend from about 1 mm. above the pins and diatoric openings to about 1 mm. above the rim of the denture.

(7) Place small strips of the dark rubber close against the pink rubber in the region of the buccal surface of the second molars.

(8) Place additional strips of dark rubber against the bicuspids and molars on the palate.

(9) Cover the remaining portion of the palate with the dark rubber, and add sufficient rubber over the entire surface to completely fill the space formerly occupied by the wax. It should be filled so that a little excess may be squeezed out

around the edge of the denture when the flask is closed. See Fig. 43.

(10) The lower denture is packed in a similar manner as the upper with the exception of having a tongue space instead of the palate. The lingual flanges of the lower denture are packed with the dark rubber, and are carried just 1 mm.

Fig. 43

beyond the periphery of the denture. The tongue space of course is left free from rubber.

(11) If much time has been consumed in packing the case, and it has become cold before the packing operation is completed; it may be returned to the oven and reheated.

(12) When the packing of the case has been completed, a piece of wet cellophane is laid over the entire lower half of the flask, and the two parts of the flask are then brought together.

(13) Place the flask in a flask press and immerse both in a pan of boiling water for about 15 minutes. Remove from water and cautiously apply pressure with the screw. Too much pressure must not be applied in closing the flask.

(14) The flask is removed from the press and opened. If too much rubber has been expressed, the excess is removed and the operation repeated.

(15) If rubber is insufficient, add more and repeat the process. See Fig. 44.

(16) Adapt a piece of wet cellophane to the cast before the final closing of the case. As the tissue surface of the completed denture is never polished, this step is necessary to insure a dense, smooth surface. Tin-foil may be adapted to the case in place of the cellophane, if desired.

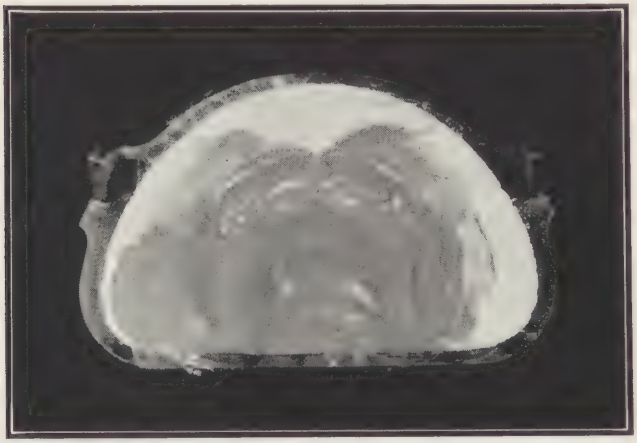


Fig. 44

32. *Vulcanization*

(1) Fill the vulcanizer pot with warm water to a depth of one inch.

(2) Place the flask clamp containing the flask in the vulcanizer and adjust the vulcanizer cover.

(3) Open the blow-off valve.

(4) Light the burner under the pot and adjust it until the blue flame just covers the bottom of the vulcanizer. Never allow it to reach up the sides.

(5) Set the gas regulator to 320 degrees, or, according to vulcanizing directions.

(6) Allow all air to escape and when steam begins to be expelled, close the blow-off valve, using a wrench.

(7) Set the time clock to shut off the gas at the required interval.

(8) Vulcanize for one and one-half hours from the time the blow-off valve is closed. Allow 35 minutes to reach 320 degrees. Maintain this temperature for 55 minutes.

(9) The time regulator will shut off the supply of gas as regulated.

(10) Allow vulcanizer to cool for 15 minutes, then open blow-off valve, until steam begins to escape.

(11) After all steam has escaped, remove the vulcanizer cover.

(12) Remove flask from vulcanizer and allow to cool for 15 minutes. Then place it in cold water until thoroughly chilled.

33. *Cleansing and Polishing of Dentures*

(1) Remove the flask cover.

(2) Using a plaster knife, remove the plaster from around the edges of the upper part of the flask until the teeth are exposed, as well as the bucal and labial surfaces of the denture.

(3) With a knife inserted between the upper and lower portions of the flask, carefully open it without applying too much pressure.

(4) Carefully remove the denture from all surrounding plaster.

(5) Wash all excess plaster from the denture with a stiff bristle brush, while holding it under cold water.

(6) With a sharp pointed knife, peel away all the tin-foil or cellophane from the tissue surface of the denture.

(7) Cut away all excess vulcanite from the rim of the denture, being careful not to mar the peripheral border.

(8) Partial dentures are removed in the same manner, only more care must be taken in their removal as they are easier to distort or fracture.

(9) Using either a half-round vulcanite file or an abrasive wheel mounted on the lathe, remove all excess vulcanite from around the edge of the denture.

(10) In partial dentures, use a rat-tail vulcanite file around the cervical edges to bring it to the proper limits.

(11) Remove all roughness from labial, buccal, palatal, and lingual surfaces of dentures by using a vulcanite scraper.

(12) Carefully smooth the denture with sandpaper. In using sandpaper it is easy to take away too much vulcanite, thus

exposing some dark rubber on the labial surface or making the denture too thin. It is also possible to permanently harm the denture by generating too much heat in this polishing process.

(13) Carefully trim the vulcanite about the necks of the teeth on the buccal, labial, and lingual surfaces with *sharp* vulcanite trimmers. A *sharp* trimmer *must* always be used in this procedure to avoid undue pressure and to give a polished finish to the vulcanite.

(14) All the steps previously described are preliminary to putting the final polish on the denture. It is necessary to obtain this high polish for the health and comfort of the patient. Vulcanite dentures are more or less porous and have a tendency to absorb saliva and accumulate food particles. High polish will reduce this porosity. Make a putty-like mix of fine pumice and water and, with a brush wheel rotating toward the operator, proceed to polish the denture. It should be held firmly in the hands, rocking it in a semi-circular motion so that grooves will not be cut into the vulcanite. Always keep the surface of the denture wet with pumice and use gentle pressure. Too much pressure will warp and burn the denture.

(15) Repeat this process using a linen rag wheel with pumice in place of the brush wheel.

(16) Mount large or small felt cones to the chuck of the lathe and polish all areas inaccessible with the rag wheel.

(17) Make a mixture of chalk and water and with a soft flannel wheel continue to polish all surfaces of the denture.

(18) Wash with water and check to make sure that all scratches have been removed. Then with a soft flannel wheel apply powdered oxide of tin for the final polish.

Section VII

Acrylic Resin Dentures

34. *General*

The acrylic resins are used by the dental profession, in order to have a denture material with better esthetic qualities than vulcanite and, at the same time, without sacrificing strength and durability. A great many synthetic materials have been de-

veloped and marketed from time to time, but the acrylic resins seem to be the best so far developed. There are various acrylic resins on the market and the procedure may vary slightly according to the material, but the basic technique is very much the same.

35. *Procedure.*

(1) Wax up as if the denture were to be made of vulcanite, except that the wax should be a little fuller in the interproximal spaces to allow for tin-foiling.

(2) Invest the case in the lower portion of the flask as for a vulcanite denture.

(3) The cast is now ready for tin-foiling. This is a most important procedure in the construction of acrylic resin dentures as any error in this step will result in the final denture being weakened and spotted. It is necessary to have all surfaces *covered completely* with tin-foil. For the upper cast cut four pieces of tin-foil. One piece to fit the palate, two to fit the buccal surfaces, and one to fit the labial surface of the denture. Additional tin-foil is then cut to cover the plaster in the flask. The tin-foil for the lower case is the same with the exception of the part that will cover the lingual surfaces and the tongue spaces. This should be cut square and then rounded in front.

(4) Cut the palatal piece of tin-foil into two triangular pieces. With a small piece of cotton, burnish the tin-foil on the wax of the palatal surface of the upper denture and overlap these two pieces in the center of the palate about one-fourth of an inch. Extend the tin-foil to about one-eighth of an inch below the incisal and occlusal surfaces of the teeth.

(5) Cut little V-shaped grooves in the tin-foil, covering the teeth on the labial, lingual, and buccal surfaces so it may be adapted into the interproximal spaces between the teeth.

(6) Remove one side of the palatal tin-foil and apply glue to the overlapping margin and replace on the waxed case.

(7) Adapt the labial and buccal pieces of tin-foil to the waxed surfaces from about one-eighth inch below the incisal and occlusal surfaces of the teeth. Use the separate pieces of

tin-foil to cover the plaster surface. Seal the overlapping margins with glue. See Fig. 45.

(8) In lower cases adapt a piece of tin-foil to cover the tongue space.

(9) The remainder of the flasking procedure is identical to that used in vulcanite.

(10) Boil out the wax in the same manner as previously described, washing the cast with chloroform followed by acetone. Make sure all acetone has evaporated before proceeding to pack the case.

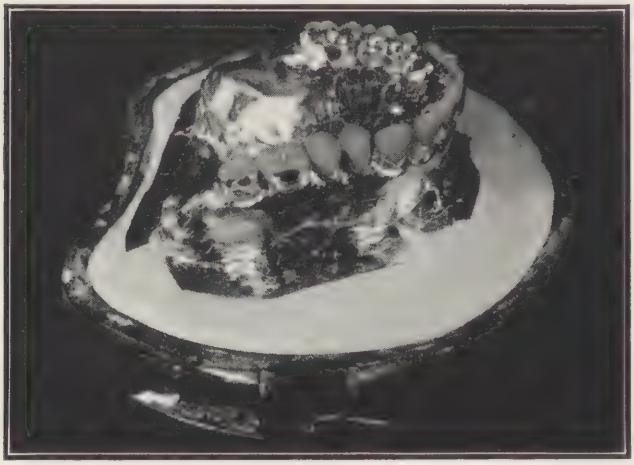


Fig. 45

(11) In acrylic resin dentures it is necessary to tin-foil the cast. This is done after the case has been flasked and separated.

(12) Acrylic resins usually come in two types. One type is the cake, and the other is the powder and liquid. The last mentioned is preferable and will be the one described. Have a clean sheet of paper about eight inches square on the bench. Place the powder cup, in which the material comes, in the center of the sheet of paper and pour the powder into the cup until it overflows. Scrape off all excess powder with a straight edge until the powder is level with the rim of the cup. Do not pack the material, or jar it into the cup. Pour the powder so measured into any porcelain vessel, such as a coffee cup. Measure out about 8 cc. of the liquid and add

to the powder in the cup. Immediately begin mixing vigorously with a clean, stiff, stainless-steel spatula. Continue this mixing until the material begins to be homogeneous and loses most of its stickiness. This should take about one minute. Then roll the mixed material between the palms of the hands for five to ten seconds. The hands, of course, should be clean and dry. For repairs, or if it is desired to make smaller or larger mixes than by the measuring cup, different quantities in correct proportions should be used.

(13) The case is then ready to be packed. This should be done as quickly as possible after mixing. When first mixed, the material is very soft and easy to pack, but upon standing, it becomes stiffer and requires more pressure to close the flask. The flasking should be done soon after boiling out so that the flask will be warm but not hot. A good temperature is 100 to 125 degrees F. Roll, between the hands, a piece of the material about the size of a lead pencil and sufficiently long to cover the teeth. Pack this well down against the teeth, making sure that no air is inclosed. Next roll up another piece about the thickness of the little finger and long enough to go around the arch. Immediately press this to place with the fingers. In upper cases it is necessary to put a sheet of the material over the palate.

(14) The flask may be trial separated by placing a strip of moist cellophane over the material in the flask before closing. Close as quickly as possible in any convenient press. Do not apply any extra heat to the flask to facilitate closing as this will only hasten the setting of the material. The flask is then reopened and material either added or cut away as necessary. It is now ready for curing.

(15) The case may be cured in a vulcanizer or in boiling water. Either way gives good results. In the vulcanizer, any curing temperature from 212 to 320 degrees F. and a minimum time of one hour may be used. Cooling, after curing, is done in the same manner as for vulcanite.

(16) The simplest manner in which to cure the denture is to place the case and the flask in a pan of cold water. This water is then brought to a boil and allowed to boil for about 40 minutes. The case is then allowed to cool very

gradually (preferably overnight) before opening. The case is opened, the denture removed and polished in the same manner as previously described.

Section VIII

Denture Repair

36. *Simple Repair*

(1) Bring the fractured edges of the denture into apposition and seal them together with a little sticky wax. Pieces of stiff wire are laid over the fractured denture at right angles to the line of fracture and waxed in place. This gives the denture additional support.

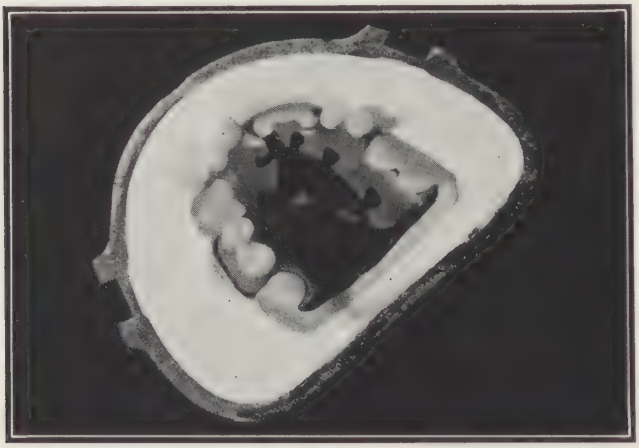


Fig. 46

(2) Lubricate the tissue surface of the denture with petrolatum.

(3) Place boxing wax around that part of the periphery of the denture that makes contact with the natural teeth.

(4) Make a plaster mix and pour a matrix or cast of the denture as described in pouring impressions.

(5) When the plaster has set, remove the denture parts and with abrasive chucks and vulcanite burs, grind away a large portion of the palate on each side of the fracture. Also remove about two mm. of vulcanite from the periphery of the denture over those areas containing artificial teeth. The margins of the palatal area are then dovetailed as shown in the illustration.

(6) Replace the fractured parts on the cast, fill in the missing parts of the vulcanite with wax, making this wax a little thicker than the original vulcanite. This will allow for the finishing and polishing of the denture. See Fig. 46.

(7) Pour the lower and upper portions of the flask as done in a new case.

(8) After the plaster has set, the wax is eliminated and the flask carefully opened. The denture will be contained in the upper half of the flask.

(9) With a vulcanite bur, remove about one-half mm. of vulcanite from the entire tissue surface of the denture. The surface is roughened. See Fig. 47.

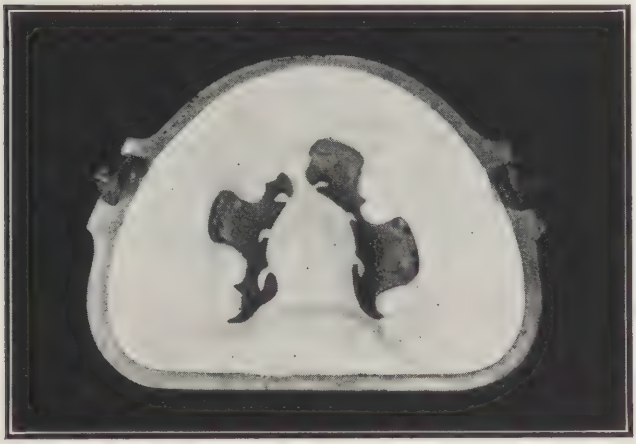


Fig. 47

(10) Proceed to pack the case as usual and then place a piece of wet cellophane over the case before the final closing.

(11) The case is then vulcanized and finished as previously described.

37. *Loose or Broken Teeth*

(1) When the original tooth has become loosened and can be replaced, it is only necessary to make certain it fits in its exact position as marked on the vulcanite. Then cut a dovetail in the lingual or palatal surface of the vulcanite adjacent to the tooth, replace the tooth in its original posi-

tion and secure it by wax. The case is then carried forward as in the simple repair.

(2) When the tooth has been broken or lost and a new tooth is necessary, but the denture base at the site of the tooth is intact, it is necessary for the dental officer to supply the technician with a wax bite indicating the relationship of the teeth of the opposing jaws. Proceed as in simple repair until matrix is poured. Fit the teeth of the denture into the depressions on the bite, and seal it to the denture. Fill the depressions left in the bite by the teeth of the opposing jaw, with plaster. The matrix of the denture and the poured bite are then mounted on an articulator, after which the bite is removed. Place the new tooth in the correct position, as governed by the adjacent and opposing teeth. Do not grind away any of the vulcanite from around the neck of the tooth, but do all necessary grinding on the tooth itself. Wax into position and proceed as in simple repair.

38. *Teeth Added*

Often a tooth is extracted requiring the addition of an artificial tooth to a partial denture. The technician receives the impression of the mouth that has been taken with the denture in place. If the impression has been taken in plaster, it must be painted with a separating media. A wax rim is placed around the periphery of the denture and the cast is poured. The bite is placed in its correct position on the denture and waxed in place and poured. The denture, cast, and bite are then mounted on an articulator. The bite is removed and the additional teeth are added to the denture, as described above, and the process followed as in a simple repair.

39. *Loose Clasp*

The dental officer has taken an impression of the clasped tooth with the clasp and denture in position. The impression is poured as directed for adding teeth to a partial denture. The vulcanite is cut out from around the tail piece of the clasp, and this area filled with wax. The case is then carried to completion as previously described.

40. *Refacing*

Lubricate the inner surface of the denture and fill with plaster, forming a matrix. Allow to set. Cut away the labial and buccal vulcanite to about one half of its original thickness, making certain the rubber is removed from around the necks of the teeth. Honeycomb the remaining gum rubber to roughen it. Wax the labial and buccal surfaces of the denture. Flask the case by

Fig. 48

filling the lower part of the flask with fairly stiff plaster and setting the denture into this plaster with the teeth down. Make sure that the teeth are at least ¼ inch from the bottom of the flask, and that all the waxed parts are exposed. Smooth the plaster around the teeth and over the rear of the denture. The upper part of the flask is poured after lubricating and the case is continued as in simple repairs. See Fig. 48.

41. *Rebasing*

Often the gums will shrink or pull away from the denture after it has been worn for some time. This causes the denture to become loose and irritating to the patient. If the denture is in good condition otherwise, it may be repaired by adding a new base or foundation of vulcanite. The technician receives the denture, to the base of which has been added a sufficient amount of material to correct the deficiency in the mouth of the patient. This material is usually modeling compound, but it may be plaster, or, both. A strip of boxing wax is placed around the

periphery of the denture and the cast is poured as described. The case is then flasked the same as if it were a new denture. After the two parts of the flask have been separated, the impression material is removed. The tissue surface of the denture is roughened by vulcanite burs and stones to facilitate the addition of the new vulcanite. Sufficient vulcanite should be removed to allow for about 1 mm. of new rubber. The case is packed with strips of base rubber, the flask is closed and the case carried to completion as previously described.

42. *Duplicating a Denture*

Frequently it is necessary to replace the entire denture base with new material. The technique as given here does not require the case to be mounted on an articulator. Proceed as in any simple repair until the matrix is poured. Make several deep grooves on the buccal and labial surfaces of the old denture. Lubricate the teeth and the buccal and labial surfaces of the denture and matrix. Build a plaster index around the entire outer surfaces of the denture and matrix, extending the plaster to about one-fourth inch from the incisal and occlusal surfaces of the teeth. Before the plaster sets too hard, make a cut opposite each cuspid tooth. This weakens the plaster index which is carefully removed as soon as it is sufficiently hard. Lift the denture from the matrix and remove all the teeth from the denture by covering them with a layer of melted basewax and then passing the denture several times through a flame to soften the vulcanite. The teeth are arranged in their proper position as indicated on the plaster index, and are secured with sticky wax. A baseplate is constructed over the matrix and the plaster index containing the teeth is arranged around the matrix with the baseplate. Melted basewax is flowed into the spaces between the teeth and the baseplate. The sticky wax holding the teeth is removed as well as the index. The waxing is finished where necessary without disturbing the position of the teeth. Proceed with the flasking as described. It is sometimes necessary to use basewax instead of the baseplate to avoid displacing the teeth in the index.

43. *Repairing Acrylic Resin Dentures*

Bring the broken parts of the denture into apposition and wax them securely together. A cast is then poured, as in the vulcanite

case. The model is then removed and tin-foiled. Replace the denture on the model and rewax if necessary. Tin-foil the complete denture, holding it in place with a little thin glue. Do not tin-foil the wax portions. Flask as for a vulcanite repair. Boil out the wax, but do not use chloroform or acetone to clean the cast. Tin-foil the plaster in the upper half of the flask that will come in contact with the denture or the repair portions. A small mix of the powder and liquid is made, as previously described, and this material is packed in the repair portion and the flask closed. The denture is cured as for a full denture. If the case has undercuts so that the denture can not be removed from the cast, it is necessary to tin-foil the denture before pouring the model.

Section IX

Clasps and Bars for Partial Dentures

44. *General*

Clasps are simple, direct retainers applied to two or more opposite, sloping or convex surfaces of remaining natural teeth, which are chosen for that purpose during the designing of the denture. For convenience clasps may be divided into three classes; namely, one arm, two arm, and three arm clasps, according to the number of arms which are applied to the surfaces of the tooth. These may be either wrought or cast clasps. The former are constructed by bending a piece of gold clasp wire to conform to the tooth, and the latter are constructed by casting the clasps using a special gold alloy. Both types have a definite place in dentistry and although there are many variations of both, this manual will deal only with those types that are commonly used. In order to understand the construction of a clasp —no matter what type it may be—it is necessary to study the shape and contour of the crowns of the teeth so that these surfaces may be used to the best advantage. The fundamental reason behind all clasps is to obtain the maximum amount of retention for the denture, and still allow it to be easily inserted and removed from the mouth. It must be understood that it is impractical to clasp some teeth, due to their anatomical characteristics or position, therefore, it is essential that the dental officer take great care in the designing of the case. The three simple diagrams in Fig. 49 will clarify the fundamental mechanical

theory which must be understood in order to construct efficient clasps.

Diagram *A* shows that each tooth is divided into two separate parts by its line of greatest circumference. Nothing above this line can be used for retention. Therefore the parts of the clasp from which no retention is obtained are placed on this half of the tooth. This includes the body or rigid portion and the occlusal

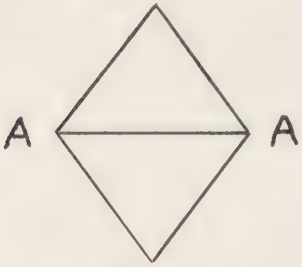


Fig. 49, Diagram A
Diagrammatic sketch illustrating line of greatest circumference of tooth.

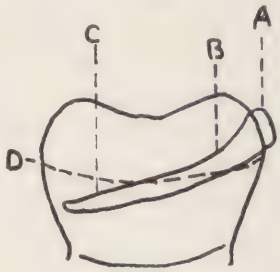


Fig. 49, Diagram B
(A) Body of Clasp. (B) Shoulder of clasp. (C) Arm of clasp. (D) Line of greatest circumference on tooth.

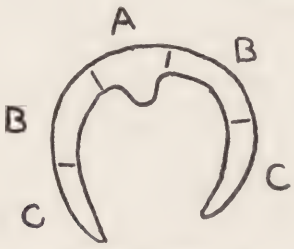


Fig. 49, Diagram C
Sketch of clasp illustrating various parts. (A) Body of clasp showing occlusal rest. (B) Shoulders of clasp. (C) Arms of clasp.

rest. The parts of the clasp that extend out from the body for a short distance are known as the shoulders. As we rely on the shoulders for rigidity and not for retention, they should be placed either on the line of greatest circumference or just crossing it. Extending from these shoulders are the thin flexible arms from which the retention is derived. These arms must always be below the guide line and in the undercut of the tooth. Therefore, they are placed below the line of greatest circumference, as shown in diagram *B*. The body and occlusal rest of the clasp

are above the line, the shoulders on or crossing the line, and the arms below the line. If this rule is followed, the clasp will give maximum efficiency. It is the duty of the dental officer to survey each case before giving it to the dental technician, marking on the cast the teeth to be clasped, the outline of the clasp and rest areas, and the outline of the entire denture. In a partial denture with two or more clasps, it is necessary to take into consideration the fact that while one clasp may be easily removed from the tooth, another clasp when attached to the denture may be in such a position as to make its removal impossible. Therefore, a mean vertical plane must be determined when the case is surveyed, which will coincide with the path along which the clasps will tend to seat themselves, when attached to the denture. This is known as the *path of insertion.*

45. *Wrought Clasps*

Wrought clasps, as stated above, are constructed by bending a piece of either round or half-round gold clasp wire of the desired gauge to conform to the tooth to be clasped. One of the most commonly used methods is to clasp a tooth adjoining a space caused by the extraction of one or more teeth. This allows sufficient room for the body of the clasp. However, it is frequently necessary to clasp a tooth which is in contact with the teeth on each side of it. As there is no room between the teeth to accommodate the body of the clasp, a different design must be used. However, the actual bending of the wire is done the same in each case. In the simple three arm clasp, using a tooth adjoining a space, the following technique is followed:

(1) Anneal the wire before any bending is attempted. This is done by holding it in an open flame until it assumes a cherry red color. It is then plunged in cold water, which removes the stiffness from the wire and makes it much easier to bend into shape. This annealing process should be repeated after each bending during the construction of the clasp.

(2) Place one end of the wire on the lingual surface of the tooth, where the outline of the clasp terminates, and note the point where the wire leaves the surface of the tooth. Grasp the wire with suitable wire bending pliers and bend it slightly so that a greater length of the wire comes in

contact with the tooth when tried on the model. It is then annealed and the point where it again leaves the tooth is noted and bent as before. This procedure is carried out until the clasp is conformed to the entire outline of the clasp on the model. As the buccal end of the clasp is approached, the length of wire to be used is judged and the remainder cut off with a pair of cutting pliers. The ends of the clasp are rounded with stones and burlew discs.

46. *Occlusal Rests*

In practically every partial denture case it is necessary to construct a third arm or occlusal rest as part of the clasp. This part will extend from the body of the clasp, over the marginal ridge of the tooth and rest on a small section of the occlusal surface.

Fig. 50
Diagram of the construction of an occlusal rest.

In this way the tooth can actually be made to bear most of the stresses of mastication instead of the tissue surfaces, and prevent the denture from settling down and forcing the clasp onto the gingival tissue around the neck of the tooth. Since the occlusal rest must bear quite a load it must be of sufficient strength to prevent breakage. A small piece of 36 gauge pure gold plate is

Fig. 51

Fig. 52

placed against the model at a point corresponding to the body of the clasp. This is shown in Fig. 50.

The clasp is placed over the tooth and the end of the gold plate below the clasp is bent up and around the wire clasp, and se-

cured with sticky wax. The lug and the clasp are removed from the model and soldered together with a very small piece of solder, making certain that the relationship is not destroyed. The clasp with the lug is then replaced on the model and the pure gold is burnished over the small part of the occlusal surface, as outlined on the model. The gold is trimmed to conform with the outline, leaving a small excess around the margins. See Fig. 51.

A short piece of half round wire is bent to the shape of an L and laid over the rest as shown in Fig. 52. When soldered, this wire will reenforce the occlusal rest.

The clasp, lug, and wire are removed from the model and carefully invested in a small amount of investment material. The investment is allowed to come just to the margins of the lug. The investment is allowed to set and then gradually heated over an open flame until quite hot. Using a blow torch, small pieces of either 18 or 20 carat gold solder are fused over this lug, further attaching it to the clasp and at the same time adding thickness to the lug so that it will have sufficient strength to withstand the stresses of mastication. The clasp with the occlusal rest is removed from the investment and polished. It is returned to the model and checked for accuracy. This procedure is repeated for all clasps requiring occlusal rests.

47. *Heat Treatment of Gold*

As the repeated annealing of the gold clasp wire causes it to become soft and pliable, it is necessary to restore its hardness and elasticity by retempering after the work has been finished. To do this, the clasp is placed in an oven and heated to a temperature of 840 degrees F., and held at that temperature for 10 minutes. It is then allowed to cool to 480 degrees F., over a period of 30 minutes. If an oven is not available, heat in an open flame to a cherry red and allow to cool in air.

48. *Crib Clasps*

As stated previously, the design of the clasps may be altered to suit the case. Frequently, it is necessary to construct a clasp for a tooth which is in contact with the adjoining teeth. An example of his type of clasp is shown in Fig. 53.

In this type of attachment the body of the clasp is placed in the embrasure between the teeth instead of beside the distal or mesial surfaces. Preparation for this should be made in the

mouth before the impression is taken, and the technique of bending the clasp is exactly as described previously. This may be either a single clasp or a double clasp, as shown in Fig. 53. In the double crib clasp a slight modification is used. Instead of bending the gold clasp wire around one tooth, it is bent in the shape of an S, starting at the lingual surface of one of the teeth to be clasped, continuing to the proximal surface of the tooth,

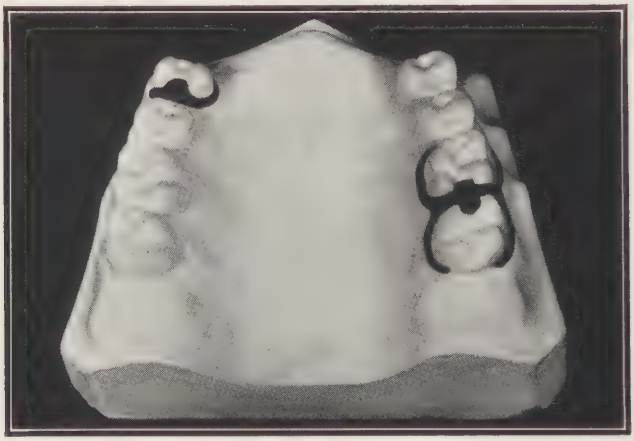


Fig. 53

and crossing the embrasure between the teeth, as described. But, instead of continuing around the buccal of the same tooth, it is bent so as to form the buccal arm of the clasp for the other tooth to be clasped. When this S-shaped wire is formed, two other pieces of wire are bent to complete the unfinished arms of the clasp. These pieces are soldered to the S-shaped wire in their correct positions, thus completing the double crib clasp. Always construct an occlusal rest for all crib clasps in order to prevent the wire from separating the teeth, thus endangering their continued usefulness.

49. *Cast Clasps*

The designs, as already given for wrought clasps, will also apply to cast clasps. Frequently, in the designing of partial dentures this is the type indicated. The impression of the teeth to be clasped is usually taken in plaster or hydro-colloid impression material. The impression is boxed in either moldine, if a metal model is to be made, or wax, if the model is to be poured with investment plaster. The fit of the clasp is usually more accurate

when cast directly on the investment plaster model. Therefore, this will be the technique described in the manual. The outline of the clasp is traced on the model by the dental officer. A piece of 30 gauge base wax is wrapped around the tooth and sealed with a warm spatula so that it will not move from position. The outline of the clasp which shows through the wax is then covered with a thin layer of either green or blue casting wax. After

Fig. 54

applying the wax, it is carved and smoothed to the shape of the clasp, which should also include the tail portion or that part that is to be used for anchorage. It is much easier to cast the tail piece as part of the clasp, than to make it of wire and then solder the two parts together. This anchorage should be of sufficient length to allow maximum retention in the denture material and should be made in the form of a loop to facilitate this retention. The outline of this loop should be marked on the model at the same time that the clasp is outlined and the waxing done as the clasp is waxed. When the wax clasp and tail piece are carved and smoothed, the case is sprued by attaching a tapered wire, such as a phonograph needle to the wax clasp, and holding it in place until it has cooled sufficiently to secure it. The clasp can then be invested and cast the same as any gold inlay or three-quarter crown. (See crown casting.)

50. *Indirect Retainers*

In addition to the direct retainers or clasps, it is sometimes necessary to incorporate in the design of a partial denture, an

additional form of retention. This is known as an indirect retainer. It may be defined as the utilization of a force, remote from that part of the denture to be retained, between which another of the direct forms of retainers is interposed; the resultant force tending to seat the denture more firmly in position. In Fig. 54 it can be seen that the extension arm or bar, touching the lingual surfaces of the lower incisor teeth, checks the denture and prevents its distal portion rising under stresses of mastication. The work (retaining the denture), coming from the power (the contact of the indirect retainer upon the teeth), through the fulcrum (the direct retainers on the clasped teeth). There are many modifications of this design, both for upper and lower dentures, that will depend upon the individual case.

51. *Lingual and Palatal Bars*

A lingual bar consists of a connecting piece of material running adjacent to the soft tissue on the lingual side of the lower front teeth, beneath the tip of the tongue, joining the two sides of a lower partial denture and making it one unit. Palatal bars may be defined as metal bars constructed to fit the surface of the vault of the palate and connecting the two lateral sections of an upper partial denture. Lingual bars may be obtained in a ready-made form and all that is required is to adapt it to the individual model. However, in a few cases this is not entirely satisfactory, and it is better to cast the lingual bar as well as the palatal bar for these cases. The design of the bar is drawn on the model with an indelible pencil by the dental officer. It is frequently necessary to place a strip of adhesive tape on the model to provide relief before adapting the wax. The outline of the bar on the model is oiled, and over this outline is adapted a piece of 30 gauge baseplate wax. Blue inlay wax is melted and placed over this outline, which shows through the first layer of base wax. It is then trimmed and carved to the exact shape of the completed lingual bar. See Fig. 55.

After smoothing the wax it is sprued, removed from the cast, washed with green soap and water, invested, and cast in saddle and bar gold.

52. *Duplicating a Master Model*

It is frequently necessary to make a duplicate model or an exact reproduction of a master model. An example of this is

the construction of any cast appliance. Lubricate the master stone model and place in the duplicating flask with the teeth up. If no duplicating flask is available, a tin can may be used that has had the ends removed. Pour the hydro-colloid duplicating material around the sides of the model and then all over it, completely filling the flask. The hydro-colloid material is boiled in any pan or coffee pot and then cooled to a temperature of be-

Fig. 55

tween 140 degrees and 160 degrees F. Immediately put on the top of the flask, tighten and set screw, and immerse in a pan of cold water. When the hydro-colloid material has completely set (15 to 30 minutes) the bottom of the flask is removed, and the master model carefully removed. Dry off any excess water from the surface of the impression and immediately pour with investment plaster. As soon as the investment is poured, dust some dry investment powder on the back of the model to absorb the excess water. Allow the investment to set forty-five minutes. The hydro-colloid is then broken away from the model.

Section X

Fixed Bridge

53. *General*

The dental technician need not concern himself about the details involved in the preparation and construction of the crowns or inlays used to attach the bridge to the abutment teeth of the

patient. The dental officer performs all of this preliminary work and the case usually comes to the technician with the attachments made and in place on a model. This manual will deal with the construction of the bridge from this point. A fixed bridge is a replacement for missing natural teeth, either in the front or back of the mouth, with the abutment teeth to which the bridge is attached bearing the entire stress of mastication. This is differentiated from a partial denture where the attached teeth bear only part of the load. A fixed bridge is, as the name implies, fixed in the mouth and may not be removed by the patient.

54. *Anterior Bridge*

(1) Assuming that the bridge to be constructed is an upper-anterior, six-tooth bridge supplying the upper centrals and laterals with attachments on the cuspid teeth, and the models have been mounted on an articulator, select four facings of the correct shade and mould that will snugly fit into the space. This may be done by placing a little soft wax in the space, and trying-in various sizes and moulds of teeth until the proper effect is obtained.

(2) Grind these facings to fit the model. All of the grinding is done on the gingival end of the facing and never on the incisal end. Therefore, it is necessary to select facings that fit the case as nearly as possible to minimize this grinding.

(3) Select a backing for each one of the facings, being certain that the backing is just a little longer towards the incisal than the facing. This is very important, as a short backing will not protect the porcelain facing during the stresses of mastication, thus causing it to break.

(4) Trim the backing mesially, distally, and on the gingival end to fit the facing that has been previously ground to fit the model. Leave the incisal end of the backing longer than the facing. Have the facing in place on the backing and file obliquely across the incisal edge from gold to porcelain with the point of the file pointing gingivally; finish the metal down to almost a continuous line with the porcelain. Leave just enough backing so that the metal will take most of the biting stress instead of the porcelain,

and still not show more than a hair line of gold at the incisal edge. This procedure is followed on all the teeth.

(5) Assemble the facings and backings on the model in the exact position that they will be in when the bridge is completed. Make certain that there is just a hair line of space between each one of the backings to allow for expansion of the metal during soldering. Wax them into position by flowing a little sticky wax between the junctions of the backings. Remove the porcelain facings, leaving the backings in the correct position. Paint the post sides of the backings with a little antiflux.

(6) Invest the model with the backings in place in a suitable soldering investing material. The investment should cover everything but the posterior surfaces of the backings and the abutting surfaces of one backing to the other.

(7) In a case requiring three or four facings, further reenforcement than just the solder is indicated. A piece of 16 gauge clasp metal gold wire is bent so that it rests against each backing between the contact point and the angle and reaches from abutment to abutment.

(8) Carefully flow 18 carat gold solder over the entire exposed surfaces of the backings until sufficient thickness is obtained for strength. Make certain that the solder has united the backings to the abutment crowns and that the reenforcing wire is completely covered by solder.

(9) Allow the case to cool slowly and then remove it from the investment. Cleanse the gold by washing with water and then boiling in sulphuric acid.

(10) Put on the facings and return to the dental officer for try-in and finishing.

Section XI

Waxing and Casting of Three-Quarter Crowns

55. *General*

Three-quarter crowns are generally used as attachments for fixed bridges. They have the advantage over the full gold crown of not showing as much gold but still having sufficient retention

to hold a bridge in place. This retention is brought about by two parallel grooves made in the tooth preparation, one on the mesial and one on the distal.

56. *Procedure*

(1) The dental officer will prepare the tooth and take an impression. This impression is generally taken by fitting a copper band around the tooth so that it fits snugly at the gingival margin. This band is filled with soft impression compound, pushed over the tooth, and held in place until it hardens. It is then removed.

(2) An amalgam model is then made from this impression, by mixing in a mortar and pestle seven parts of amalgam alloy and five parts of mercury, by weight, and triturating for three minutes. This amalgam is worked in the palm of the hand for two or three minutes, until it has thoroughly mixed. Then, using a small amalgam plugger, it is packed into the impression of the tooth, a little bit at a time. When the impression is filled, an additional piece is added so that a root-like extension is formed, thus giving the technician a handle with which to hold the model. It is allowed to set until the amalgam becomes hard. The impression material can be removed by putting it in a little warm water, thus softening the compound. Then gently pull it off the model. The model is then examined for defects. It should be a perfect reproduction of the prepared tooth.

(3) With a warm spatula carefully apply melted blue inlay wax over the oiled model. This should be of sufficient thickness to allow the carving of the wax to simulate the anatomy of the tooth in the finished crown.

(4) The wax is then carved with all the anatomical characteristics of the tooth. Make certain that the wax is the correct thickness. If it is too thin, the amalgam model will show through the wax. It is polished with a small piece of cotton and cold water.

(5) Attach the sprue to the wax model, preferably to either the mesio-incisal angle or the disto-incisal angle, and gently remove the wax from the model. The oil will act as a

separating medium and allow the wax to be easily removed.

(6) Wash the wax preparation with green soap and room-temperature water until all the oil has been removed.

(7) The technique of investing the casting will be taken up now and as it is practically the same for all gold castings, it will apply to all the other casting procedures mentioned in this manual. The purpose of investing an impression for a gold casting is fundamentally the same as investing a case for a denture. That is, to replace the space occupied by wax with another material. In this case it is gold instead of vulcanite or acrylic resin. Gold may be either cast or swaged, but the most efficient type of crown is the cast crown; so that is the method described. The apparatus used in casting dental gold consists of a sprue former or base in which the sprue sets, a casting ring which fits down over the sprue former, a casting machine or bucket to force the molten gold into the ring by centrifugal force, and a blow torch which heats the gold to its molten state. The sprue with the wax pattern attached is placed in the sprue former so that the top of the pattern will be at least one-half inch below the upper rim of the ring. The casting ring is then lined with a strip of wet asbestos and placed over the sprue former. A mix is made from any inlay investing material, according to the directions of that particular manufacturer. With a fine camel-hair brush, the wax pattern is carefully painted with this investment after removing the ring temporarily for this step. Make certain that no air bubbles are in the investing material. After the wax pattern is completely covered, the ring is placed back on the sprue former and the remainder of the investment material is then slowly poured into the ring until it reaches the top rim. A file may be rasped over the top of the ring during this pouring so that any air bubbles present will be brought to the top. Do not jar the case as this might knock the pattern from the sprue. Allow the investment to set for at least an hour, or until it is hard and the heat caused by the setting of the material has been dissipated. The importance of following the manufacturers' directions in the mixing of the

investment material cannot be over-emphasized. Gold is said to shrink 1.25 percent before the casting is made. If the investment material did not compensate for this, it would be impossible to cast a gold crown or inlay that would fit the tooth. Although the investment materials will cancel the gold shrinkage, it must not be forgotten that unless some form of control is exercised, the results may be over-expansion as well as under-expansion. This is due to the various sizes of the inlays or crowns to be cast. The investment technique has been standardized as much as possible by using a super-expanding investment, such as Cristobalite with the control affected through the medium of a control powder. Depending upon the size of a wax pattern, a certain amount of this control powder is substituted for a certain amount of Cristobalite, as given in the directions covering the use of these materials. Due to the fact that this balance is obtained before the mix is spatulated, it is possible to burn out all the cases to the same degree of mould temperature and still have the correct amount of expansion. Weigh out room-temperature water, Cristobalite, and control powder on the automatic scale. Spatulate, and invest the pattern in an asbestos-lined ring, using a single mix. Let the investment set at lease 30 minutes. Place in a cold oven and burn out gradually. Cast when a temperature of 1300 degrees F. is reached. Whether the casting is done in a casting machine or a hand bucket, the end-result is the same. In preparing the gold for casting it should be melted in the reducing flame of the blow torch. This is the area just ahead of the inner cone and the area that keeps the metal bright. This is done to prevent oxidation of the gold, and the addition of a little reducing flux to the melted gold at this time will further prevent oxidation. The melting should be done rapidly. When the gold takes on somewhat the appearance of mercury, the casting is made. Allow to cool slowly and then remove the casting from the ring. It is washed and pickled in fifty percent sulphuric acid. All castings are made according to the procedure just given whether they are crowns, inlays, or parts of a bridge. The only variation is in the investment material. The direc-

tions for the particular type of the casting that is to be made, must be followed in the investing of the pattern.

Section XII

The Gold Crown

57. *General*

One of the most important means of restoring a tooth deeply involved by caries, or providing a means of support for a bridge or partial denture, is the cast gold crown. Due to the require-

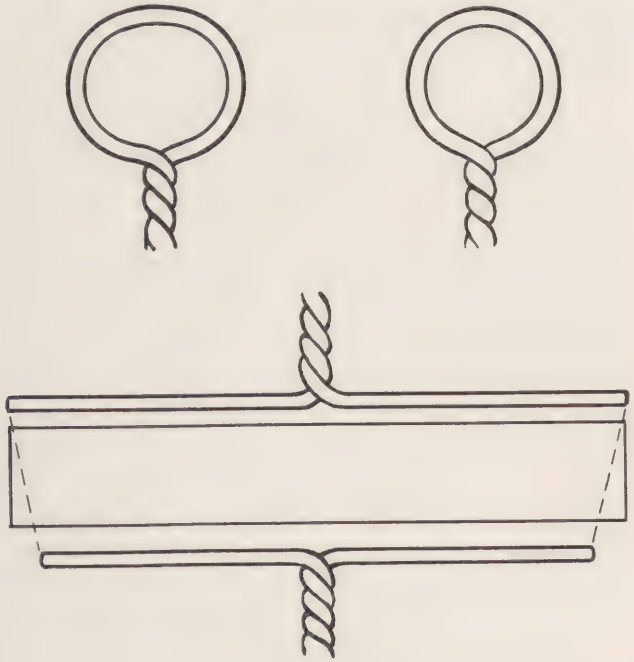


Fig. 56

ments of esthetics, it is employed for restoring posterior teeth only. The primary requirement in the construction of the cast gold crown is an accurate fit at the gingival line. One of the most serious faults of the full gold crown is the frequent occurrence of caries under the band. This can nearly always be traced to the failure in securing close adaptation of the band to the tooth at the margin. In order to obtain this adaptation the dental officer will take two measurements with a dentimeter of the prepared tooth stump. The first is taken around the neck of

the tooth at the gum line and the second measurement is taken in a similar manner at a point about one-third the length of the stump from the occlusal surface. These measurements are taken by looping a piece of wire around the tooth at each one of the points mentioned above, and tighten the wire by twisting the ends. The two loops thus formed are removed from the tooth and cut. When they are straightened out they will give the exact circumference of the crown of the tooth at each one of these points. See Fig. 56.

58. *Procedure*

(1) The measurement wires are cut and straightened out.

(2) A piece of 22 carat, 30 gauge, gold plate is cut slightly wider than the length of the tooth stump. It is cut to a length that is one-half millimeter longer than that of the longer measurement wire to allow for beveling. The shorter wire is placed along the lower edge of the gold plate, equidistant from the ends and its length marked on the gold with a pointed instrument. This measurement is also increased one-half millimeter to allow for beveling. It is seen that since one of the measurement wires is shorter than the other, the gold plate will not be cut as a rectangle, but the ends will converge slightly toward the shorter wire. Cut the band along these guide lines, as illustrated in Fig. 56.

(3) Bevel the gold band at each end at an angle of forty-five degrees using a flat file. The file is passed over the band in only one direction. The bevel is placed on the opposite side at the other end of the band so that the two beveled surfaces will overlap when the band is curved.

(4) The best method of uniting the ends of the band is autogenous soldering or sweating. This can only be done when pieces of gold of the same carat are to be united. By this means, the parts are melted or welded together without using solder. When this method is used there is no danger of the joint becoming disunited in subsequent solderings. The beveled ends of the band are bent around and under each other until the ends overlap. These ends are then pulled back and allowed to spring together upon each other, thus pressing together by the elasticity of the metal. This exact contact of the ends is necessary in autogenous solder-

ing. The joint is fluxed with a saturated solution of borax, and the band is placed on a piece of charcoal with the lapped edges up. Using a blow pipe, start with a small brush flame, continue to apply heat until the band is brought to a cherry red. When the gold begins to glisten the surfaces are nearly ready to fuse. Remove the flame immediately after the parts are united. The band is returned to the dental officer, who trims and fits it to the gum line of the tooth.

(5) The united band is then placed upon a flat surface and the occlusal edge is filed until it is in flat contact with the file. When the band is in place on the tooth stump, the occlusal edge should be the exact height of the occlusal surface of the preparation.

(6) In constructing a gold crown for a pulpless tooth, a piece of 22 carat, 30 gauge gold plate of a size large enough to cover the occlusal end of the band is selected. One side is coated with a solution of borax. The gold band is then placed on the gold plate and they are held in a bunsen burner, with a pair of tweezers, until the band is sweated to the gold plate. The excess gold of the plate is cut away so that the margins are smooth and the crown box-like. This step is only used for pulpless teeth. The technique for vital teeth will be taken up a little later.

(7) A wax bite and a plaster impression are now taken by the dental officer.

(8) Select a porcelain tooth having a well developed occlusal anatomy and of a width which will fill the space formerly occupied by the natural tooth. The occlusal surface of this tooth is covered with a coating of oil and then forced into a small block of modeling compound, the surface of which has been sofetened. The compound is chilled and the porcelain tooth removed, leaving an impression of its occlusal surface in the compound. The surface of the impression is covered with a thin coat of oil and softened inlay wax is forced into the impression. The wax is chilled and trimmed flat and level with the block of modeling compound. It is then removed from the block. The gold coping is placed on the cast and the wax occlusal form is placed in position on the coping. The wax is then

carved and adjusted where necessary to conform to the occlusion of the opposing teeth. Inlay wax is added to the approximal, lingual, and buccal surfaces of the gold coping and carved until the proper contour of the tooth is obtained. About one millimeter of gold band is left exposed at the gum margin.

(9) Attach the sprue at one corner of the crown, invest, and cast as described under the three-quarter crown.

(10) Twenty-two carat gold solder is fused over the exposed band with the blowpipe, to perfect the contour around the gingival margin of the crown. The crown is cleaned in acid and polished.

(11) When the cast gold crown is used on a vital tooth, no attempt is made to place a gold floor on the band, due to the irregular border at the occlusal surface, which is usually unavoidable in vital teeth. After the gold band has been accurately fitted at the gingival margin, the occlusal surface of the band is reduced with stones to the same heighth as the tooth stump. An impression and bite is then taken with the modeling compound, and the gold band is placed in the modeling compound impression. From this bite-impression articulated stone casts are prepared. Wax cusps are added and carved to occlusal adaptation and the crown is then cast and finished, as described.

Section XIII

Splints

59. *General*

Splints are becoming more and more important in the Army Dental Service. In warfare, injuries to the face and jaws are very common, and are becoming increasingly so. The most practical method of controlling fractures of the jaw is by splinting. It must be understood that no two cases will be the same or will use exactly the same design of splint. But they are all sufficiently similar to follow the same general basic principles of design and construction. The following designs can be used for either maxillary or mandibular splints and can be constructed of vulcanite, acrylic resin, or cast silver. The variations in material and design will be taken up in detail.

60. *Vulcanite Splints*

(1) The prepared model will come to the dental technician for the construction of the splint.

(2) The designing of the case will be done by the dental officer and will be outlined on the model. It is important that the dental technician know the following principles in the designing of all splints so that the maximum efficiency and serviceability will be obtained.

a. The splint should cover all free gingival margins on the lingual, buccal, and labial surfaces at least two or three millimeters from the necks of the teeth.

b. The splint must cover the cervical two-thirds of the teeth and must include as much of the occlusal third as possible without interfering with the masticatory processes.

(3) Adapt a piece of 28 gauge casting wax to the model to cover the design of the splint. Make certain the wax is in all the interproximal spaces.

(4) Soften a piece of baseplate wax and fold it over on its self, making a double thickness. Adapt this wax over the wax already in place, on both the lingual and buccal surfaces of the cast. Trim wax to conform with design of splint, as outlined on the cast.

(5) Make a small button of the labial surface of the wax pattern in the median line. This wax button may be stamped out of a piece of wax, using a lead pencil from which the rubber has been removed. This small disc is attached to the wax pattern, forming the small button which will be used to secure the finished splint in place in the mouth.

(6) The edges of the wax must be sealed to the model.

(7) Chill the wax in cold water and polish with cotton.

(8) Flame the wax and repolish, which will give a very smooth finish to the splint and will minimize the amount of polishing to be done later.

(9) A piece of 14 gauge half-round wire is bent to conform to the distal surface of the last molar tooth. It extends forward on both the lingual and buccal surfaces of the tooth

only touching the tooth, however, on the distal surface. The ends should come forward to almost the mesial of the tooth and then bend out at right angles, extending beyond the surface of the wax pattern. These two projections of the wire, along with that portion around the distal of the tooth, will be imbedded in plaster during the flasking process, thus holding the wire in its correct position.

(10) In some fractures, it is necessary to design the case so that a loose or broken fragment of bone in an area which is edentulous, may be held in place. This is accomplished by constructing projections of wire which will extend out from the splint and hold these fragments in place. A piece of nickel tubing 10 x 14 gauge is incorporated into the splint by soldering it to the buccal surface of the half-round wire, so that it will be parallel to the buccal surface of the teeth. A piece of 14 gauge square wire is inserted into the tubing and the other end is bent so that it will rest on the buccal tissue over the fragment requiring stabilization.

(11) Wax is melted around the nickel tubing so that it is flush with the surface of the wax pattern.

(12) The case is now ready for flasking. Trim off all occlusal surfaces of the teeth flush with the wax pattern. Soak the model in cold water until all bubbling has ceased. Flask the case in the lower part of the flask, as described in "Flasking of Denture", making certain that the plaster comes up to the lower border of the wax splint. The tubing and wires are left exposed. Use any type of separating medium on the plaster surface and then pour the upper half of the flask, as previously described.

(13) The wax is eliminated, the case is packed with rubber, vulcanized and polished, as previously described.

(14) In every space where there is a tooth missing the buccal and lingual parts of the splint are separated by sawing. The button in the median line is also sawed vertically in half. Thus, the splint is in two parts connected by wire, which can be placed in the mouth, brought into position and the two halves of the button wired together.

Vulcanite Splint illustrated in Fig. 57.

61. *Acrylic Resin Splints*

The construction of a splint, using the acrylic resin material in place of the vulcanite, is exactly the same as previously described with the exception of tin-foiling the wax pattern and the model.

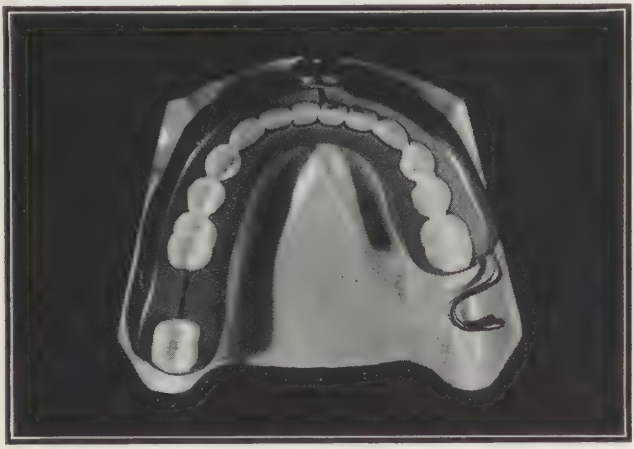


Fig. 57

This tin-foiling procedure is carried out the same as already described under acrylic resin dentures. The acrylic resin used in the construction of the splints is colorless, which has the ad-

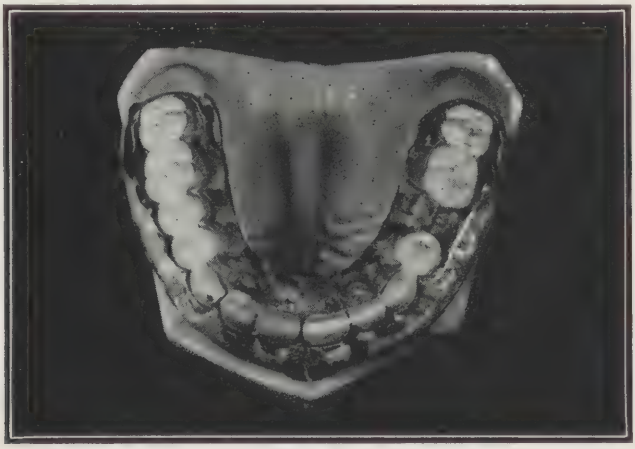


Fig. 58

vantage of being transparent, allowing the dental officer to observe the condition of the teeth and gums underlying the splint at all times. Frequently a fracture case will have one or two

missing anterior teeth. It is a simple procedure to add the necessary artificial teeth to the splint, which will replace the missing teeth until the splint can be removed. When teeth are added, it is necessary to tin-foil over the labial surfaces of the artificial teeth before the case is waxed. This will prevent the material from adhering to the labial surfaces of the teeth. Acrylic resin splint showing teeth added is illustrated in Fig. 58.

62. *Cast Silver Splints*

The third type of splint that is commonly used is the cast silver splint.

(1) Prepare a duplicate model of investment plaster.

(2) Adapt one thickness of 28 gauge wax to the investment plaster model as outlined by the dental officer.

Fig. 59

(3) Soften a piece of baseplate wax and adapt *one* thickness of it over the wax already in place.

(4) Add sufficient wax so that the surface of the wax pattern is smooth and even.

(5) 14 gauge wire is used, as previously described.

(6) The button in the median line is constructed as usual and smaller buttons are placed in the cuspid and first molar region of both sides.

(7) Seal the edges of the wax to the model.

(8) Smooth and polish the pattern as this will save needless work in the final polishing.

Fig. 60

(9) There are various ways of sprueing the case preparatory to investing and casting, but the method described in this manual will be found very satisfactory. Drill a hole

Fig. 61

through the center of the model about the size of a dime. On the inner lingual surface of the pattern are attached six small 14 gauge sprues. On the outer surface leading from

the main sprue, are attached four 14 gauge sprues attached to the buccal surface of the wax pattern. From the cuspid and molar regions of the buccal surface of the pattern, are attached 14 gauge sprues for air vents. These air vents stop at the edge of the model. Grooves should be cut in the model, both lingual and buccal, to accommodate these sprues. See Figs. 59 and 60.

Soak model until bubbling ceases. Using a camel-hair brush, paint wax pattern with casting investment, making certain that all air bubbles are eliminated. Select casting ring to fit the case and fill with remaining investment. Place the model in the investment with the teeth down and the main sprue which comes through the hole in the center of the model sticking out of the investment material. Let set for at least one hour. Place casting ring in cold oven and heat for two hours at 1200 degrees F. Add not more than 10 percent copper to the amount of silver. Melt silver and copper in crucible. Place ring in casting machine. Add borax or any reducing flux to molten metal and cast. Remove from investment and polish. Make cuts the same as previously described. A finished splint is shown in Fig. 61.

THE DENTAL HYGIENIST

CHAPTER II

Section I

General

63. *Purpose and Scope*

The duties of the enlisted dental hygienist are; the administering of prophylactic treatment or the removing of the calcareous deposits from the exposed surfaces of the teeth and roots, their polishing, and instructing the patient as to the proper method of brushing the teeth. Oral hygiene simply means sound teeth and healthy gums in a clean mouth. Hygiene teaches how to cultivate health and avoid disease, and the same thing may be said for oral hygiene. The purpose of hygiene is to establish a proper attitude toward disease and to maintain the best possible health under any given condition. The two main premises upon which the teaching and practice of oral hygiene are based are: (1) A clean tooth resists decay better than an unclean one. (2) Healthy gingiva or gum tissue resists infection better than inflamed tissue. It is the duty of the dental hygienist to teach the patient how to care for his mouth, and to practice certain measures at the chair that will assist him. This section of the manual will describe in detail the instructions to be given and the measures taken.

Section II

Saliva and Calculus

64. *Composition and Function of Saliva*

Gingivitis or inflammation of the gums, caused by dental calculus or tartar, is no different from gingivitis caused by other mechanical irritants. It is very common in neglected mouths, and is of a progressive nature due to the gradual accumulation of the calculus. In order to understand the formation and deposition of

calculus, it is necessary to know something about the saliva, as this is the medium from which it is deposited upon the teeth. The saliva is manufactured by three pairs of glands situated in the region of the mouth. They are the parotid, submaxillary, and sublingual glands, and they pour their secretions into the mouth. Saliva itself is colorless and watery, but secretions from mucous glands imbedded throughout the lining of the mouth, give it a ropy or slimy quality. The salivary portion has the function of starting certain digestive processes, while the mucous serves to lubricate the bolus of food in order to facilitate swallowing.

65. *Formation of Calculus*

The saliva contains certain organic and inorganic substances which are deposited on the teeth or any other hard structure in the mouth. This deposit, called dental calculus, may be defined as a soft amorphous or crystalline substance which is formed on the teeth in concentric layers. It is a mixture of colloids, crystalloids, food debris, and bacteria, and is clear or yellow in color upon the exposed surfaces of the teeth, but may be green or black in the gingival crevices. The deposit is soft at first, but soon the protein substances decompose and wash away, while the crystalline calcium salts are freed and left as a hardening mass which cannot be removed with a brush after a few hours. For dental calculus to form it is necessary for three predisposing factors to be present: (1) The presence of some hard object in the mouth such as natural or artificial teeth. Calculus never forms on soft tissue. (2) There must be a starting point for the formation. This is usually a roughened surface which has not been sufficiently cleansed by the friction of the food and the washing of the saliva. (3) There must be a film of organic matter spread over the tooth or hard structure.

Section III

Instruments

66. *Instruments Commonly Used*

The technique of instrumentation, as described in this manual, will confine itself to those instruments available in the Army dental clinics and to the minimum number with which it is possible to perform a thorough prophylaxis. It will sometimes be necessary to substitute certain other similar instruments for those

described. Scalers number 3 and 6 are sickle shaped instruments and are used chiefly to remove gross deposits from the teeth. Scaler number 15 has a smaller blade and is used to remove small deposits of calculus from more inaccessible places, such as between the teeth. Scalers number 33 and 34 are used for the removal of extremely heavy deposits especially from the lingual surfaces of the lower anterior teeth and the buccal surfaces of the upper molar teeth. See Fig. 62.

Fig. 62

In addition to these instruments, it is necessary to have rubber polishing cups, brush wheels, dental engine and handpiece, pumice, chalk, mouth miror, dental floss, disclosing solution, and a spray atomizer with a pleasant tasting mouth wash.

Section IV

Technique of Dental Prophylaxis

67. *Instrumentation*

(1) The patient should be instructed to present himself for treatment with his mouth in as clean a condition as possible.

(2) The teeth are thoroughly sprayed on all their surfaces with a compressed air atomizer containing any pleasant tasting mouth wash. The air pressure should be about 25 pounds so that it will have enough force to blow the spray between the teeth and aid in their mechanical cleansing.

(3) In using instruments in the mouth it must be remembered that each and every motion of the hand and fingers should always be under the control of the operator as a slip might cause a great deal of damage to the mouth tissues or the teeth. An instrument must never be used unless the hand holding it is properly steadied against some adjoining part of the mouth. The proper way to hold an instrument is to grasp it very much the same as a pencil, that is between the thumb and index finger. The blade of the instrument is placed against the surface of the tooth to be scaled and the hand steadied by resting the tip of the middle finger against the biting surface of one of the adjoining teeth. The blade is carefully carried under the shoulder of the calculus deposit; and, with a slight pulling motion of the hand and fingers, the mass is removed. This same motion is repeated a sufficient number of times to thoroughly clean the surface of the tooth.

(4) Starting with the disto-lingual surface of the lower right last molar and using either a number 3 or 6 scaler, the lingual surface of the tooth is cleaned as described. This is continued until the lingual surfaces of all the lower teeth are cleaned. Frequently it is necessary to use scalers number 33 and 34 for the lingual surfaces of the lower anterior teeth.

(5) Then starting on the disto buccal surface of the lower left last molar and using scalers number 3 and 6, the calculus is removed from the buccal surfaces of all the lower teeth.

(6) With the number 15 scaler, carefully remove all deposits of calculus from between the lower teeth in the interproximal spaces. Special care must frequently be taken in cleaning the lower anterior teeth, as they may be rather irregular, creating areas that are difficult to reach.

(7) Repeat the same routine and instrumentation for the upper teeth.

68. *Polishing of Teeth*

(1) After the calcareous deposits have been removed there still remain some stains, plaques, film and soft accretions on the exposed surfaces of the teeth. The purpose of polishing the teeth after instrumentation is to remove this debris and, at the same time, to slightly stimulate the margins of the gums.

(2) Using the same system as described for instrumentation, that is starting at the disto-lingual surface of the lower right last molar, the lingual surface of the tooth is polished by passing a rotating rubber cup, charged with pumice and glycerine across the surface of the tooth until all stains have been removed. Care must be taken so that no great amount of heat is generated by having the cup revolve too fast, or by applying too much pressure. Just a few revolutions will usually suffice to remove all the stains and too much polishing will wear away the surface of the tooth. The rubber cup should be carried just to the margin of the gum, care being taken not to injure it in any way.

(3) The buccal surfaces of all the lower teeth are polished in the manner described, as well as the lingual and buccal surfaces of the upper teeth.

(4) The main benefit, derived from the polishing of the teeth, is the prevention of initial decay. All efforts at thoroughness especially on the masticating surfaces of the teeth where a great majority of cavities occur, will do much in reducing or preventing caries. The masticating surfaces of the bicuspids and molars are so uneven that it is impossible to polish them with the rubber cup. Therefore, it is necessary to use a brush wheel to reach into the grooves of the teeth. After dipping in water to moisten the bristles, touch the brush to some pumice. Run the engine at moderate speed and polish the fissures and grooves of the teeth with the revolving brush wheel.

(5) The entire polishing procedure may then be repeated if necessary, this time using powdered chalk in place of the pumice. This gives a high polish to the teeth and aids the patient in keeping them clean.

69. *Use of Dental Floss*

After the teeth have been polished with cup and brush wheel, there still remain the contact points and areas on the approximal surfaces that have not been reached. These areas are best cleaned with dental floss. A piece of floss about 10 inches long is used for this purpose, and is wrapped around the index finger of one hand and held tightly by the thumb of the other hand. The finger and thumb should not be more than an inch apart as this will prevent the floss from snapping against, and injuring the gum tissue between the teeth. The dental floss is carefully worked between the teeth and through the contact points until the approximal surfaces of the teeth are reached. It is then drawn over these surfaces several times until all food debris has been loosened and removed. It is then pulled straight out from between the teeth and not past the contact point again. This is repeated between all the teeth, and to facilitate the polishing, the floss may be dampened and dipped in pumice before using.

70. *Disclosing Solution*

The teeth are then checked for cleanliness by painting a disclosing solution on the dried surfaces. This will make visible all stains and mucinous plaques that have not been removed. A very effective iodine disclosing solution consists of the following:

Iodine crystals	3.3 gm.
Potassium iodide	1.0 gm.
Zinc iodide	1.0 gm.
Glycerine	16.0 cc.
Distilled water	16.0 cc.

A substitute solution of tincture of iodine and glycerine, equal parts, may be used if desired. The patient is allowed to rinse his mouth at frequent intervals during the entire prophylatic treatment. When all the teeth have been thoroughly cleaned and polished, the mouth is sprayed with any pleasant tasting mouth wash.

Section V

Instructions to the Patient

71. *Method of Toothbrushing*

Prevention in dentistry is one of the most important factors to be considered. It is much better to prevent the occurrence of a dental disease than to treat it after it has obtained a start. Probably the most common of all dental conditions is caries or decayed teeth. For a tooth to decay, the process must have a starting point. This is usually brought about by the retention of food debris against the tooth surfaces, which when not removed, will be incorporated into the tartar deposits and, if allowed to remain for several hours, cannot be removed with a brush. Therefore one of the most important duties of the dental hygienist is to understand a good practical method of tooth brushing, and to be able to instruct the patient in this method. The instruction will consist of the following: Advise the patient to buy two hard bristle brushes, preferably with different colored handles. One brush to be used in the morning and the other brush at night. The different colored handles will enable him to know exactly which brush to use. The brushes should be rather small, preferably with two rows of bristles. Place some toothpaste on the dry brush and, using a slight wrist motion, start with the bristles against the gums and sweep them down, over the surfaces of the teeth, toward the biting edges. The motion should always be from gum to biting surface, and never crosswise. The posterior or back teeth should be brushed first. Then proceed forward until all the teeth are brushed, both inside and out. In this manner, the upper and lower teeth are brushed for three minutes by the clock, twice daily. Patients with badly neglected mouths should be told that this manner of brushing might cause their gum tissues to be slightly sore for a day of two, but shortly their mouths will be improved by the massage action of the brush. After the teeth have been thoroughly brushed, there still remain certain areas that are impossible to reach with the brush and must be cleaned with dental floss. Instruct the patient in the use of dental floss as previously given in this chapter.

72. *Massage*

Frequently the gums of a neglected mouth will be inflamed and swollen. This condition, known as gingivitis, can generally be

cured or remedied by prophylaxis and massage. Instruct the patient to massage his gums at least twice a day by squeezing or milking the inflamed or soft gums between the ball of the thumb and index finger, downward for the upper arch, and upward for the lower arch. In other words the motion, as in brushing, should always be toward the biting surfaces of the teeth.

THE CHAIR ASSISTANT

CHAPTER III

Section I

Duties of a Chair Assistant

73. *General*

The duties of an enlisted chair assistant are so many and varied that it is absolutely essential to establish a definite daily routine if they are to be performed in a proper manner. He must closely observe the dental officer at work and be able to anticipate his wants as to instruments and materials. He must be personally clean and neat in appearance and his contact with the patients must always be courteous and respectful. He must have a thorough knowledge of the name and location of each instrument in the office and must make certain that they are always kept in their correct place. He must see that all the instruments are sterilized before returning them to the cabinet. These are just a few of the chair assistants many duties which are described in this manual in detail.

Section II

Cleaning of Dental Clinic

74. *General*

One of the duties that the chair assistant will be required to learn will be the proper cleaning and care of the dental clinic. This includes the reception room for patients, hallways, operating rooms, and the equipment in the rooms, laboratory and private offices. A certain time should be set aside each day for this policing so that it will not interfere with the daily work in the clinic. This time will be determined by the dental surgeon, but it is usually done at the close of the days work, rather than leave the clinic in disarray until the following morning. The floors should be dusted, or waxed and polished when necessary, the chairs arranged in order, reading matter neatly placed, re-

moving such as will not be needed again. The accumulated trash should be emptied, the dirty laundry disposed of and replaced by clean. The entire clinic should be dusted and the equipment in the operating room, such as the dental unit and chair, should be wiped down daily. The unit is equipped with a cuspidor containing a straining screen. This screen will become filled with particles of filling material etc. necessitating a daily cleaning. The bowl of the cuspidor must be washed with soap and water to remove all traces of saliva, blood, etc. This is done after each patient if necessary. The headrest of the chair is usually covered with either a linen or paper towl. This should be changed after each patient.

Section III

Care of Equipment and Materials

75. *Medicaments*

The dental cabinet should contain only those instruments and medicaments that are frequently used. It should never be used as a storage space for surplus supplies as this will only complicate the care of the cabinet. Medicaments are best kept in small, square, ground-glass-stopper bottles, well labeled, with the stock bottle left in the storage room. As the materials are used, they should be replaced from the bulk of the supply. Each bottle should have a certain place in the cabinet and should be kept there when not in use. Number and label the bottles so that the numbers one and two will contain the medicaments most frequently used. They must be spaced on the cabinet shelf so that selected bottles may be removed without tipping one of the others over. In arranging them, it is best not to have medicaments of the same color next to each other. For example eugenol should not be next to phenol. The alcohol bottle may be placed between them. The danger of taking the wrong bottle is greatly reduced and the speed in selecting is materially increased. Iodine should never be kept in the cabinet as it will tend to rust the instruments.

76. *Hand Instruments*

Hand instruments should be arranged in the cabinet drawers to suit the dental officer. They should never be mixed indiscriminately, but should have a definite order. The scalers should

be placed together, preferably pairing the rights and lefts. The same is done with the cutting instruments such as chisels, hatchets, excavators, etc.

77. *Sharpening of Instruments*

The assistant will keep all the cutting instruments sharp by frequent use of the Arkansas stone. The dental officer will instruct the assistant in the proper method of sharpening.

78. *Dental Burs*

The assistant should avoid having a large number of each type and size of burs out in use at one time. With many of the burs partly worn, it is difficult for the operator to find a sharp one. Consequently, he gets a new one from stock. This is used once and then is placed with the remainder of the old burs and probably never used again. This goes on indefinitely, and consequently many burs that are still serviceable are needlessly thrown away. A very satisfactory method of handling the burs is by the use of any type of bur block that may be available whether it be round or square. The block will contain many holes in which the burs may be placed in regular order. They should be placed so that all types and sizes are readily available but having no more than two or three burs of each kind in the bur block. There are two lengths of burs; those for the straight handpiece and those for the contra-angle handpiece. The burs should be placed so that those for the two handpieces are in the same section of the block for convenience sake. The cross cut fissure burs should be placed in one group with the large size burs to the left and graduating down to the small sizes. The tapered fissure, round, inverted cone, wheel, and cutting burrs, etc. are placed similarly. If after using, the bur is still serviceable, it may be cleaned with a wire brush and sterilized and then replaced in the block. If the bur is not serviceable it is thrown away and a new bur replaces it in the bur block. In this manner all the types and sizes of burs are always available, there is no waste by discarding serviceable burs, and it is a simple matter to immediately replace all discarded burs. It is not the purpose of this manual to set down specific instructions as to where each and every bur must be placed, but only to suggest a method that is simple to use, and to impress upon the chair assistant the fact that a definite

system must be followed, no matter what it may be. This not only applies to this one particular duty, but to all duties that must be performed. All the other dental materials are handled in a similar manner, whether they be sandpaper discs, mandrels, matrix bands, etc.

79. *Sterilization of Dental Instruments*

A thorough knowledge of the methods of sterilization, their correct uses, and their limitations is absolutely necessary for the dental assistant. Practically all the dental instruments with the exception of those that are classified as cutting instrument can be sterilized in boiling water. It is first necessary to render them mechanically clean by scrubbing with soap and water. They are then placed in the sterilizer and boiled for a minimum of twenty minutes. They are then removed from the water and dried with a clean sterile towel and placed in the cabinet. A small amount of some alkaline substance such as sodium carbonate one-half percent should be placed in the sterilizer to prevent rusting of the instruments. Cutting instruments such as knives, chisels etc., should be sterilized by some other method than by boiling, in order to preserve their cutting edges. One of the most efficacious methods is by keeping them in a lysol solution. Lysol is a liquid containing about 50 percent cresol in a netural potassium soap and is three times as germicidal as phenol. Lysol acts well in the presence of organic matter and destroys spores. For the sterilization of instruments, it is used in the dilution of 1 to 3 percent.

80. *Sterilization of Handpieces*

The dental officer will instruct the assistant in the sterilization and oiling of the dental engine handpieces.

81. *Care of the Sterilizer*

At the end of each day, the sterilizer must be drained and dried with a towel. If this is not done the instruments will be coated with rust when they are removed from the sterilizer. Under no circumstances will instruments be left in the sterilizer overnight.

Section IV

Duties at the Chair

82. *General*

During the time that the dental officer is working on the patient, the chair assistant should stand by, ready to render any assistance that may be necessary. If there are other duties to be performed in the operating room, he may do them but always within sight of the operator. The best procedure to follow is to stand on the opposite side of the chair from which the operator is working and observe the progress of the work. With a little experience the assistant will be able to anticipate most of the dental officer's wishes and have the necessary instruments ready before they are called for. He should note on the appointment sheet the type of work that is to be done for the patient so that he can have the necessary instruments and materials ready. If it is a prophylaxis, a mouth mirror, scalers, fine pumice, rubber cups and brush wheels for the handpiece should be placed on the operating tray. If a carious tooth is to be prepared, a mouth mirror, exploring points, handpiece, burs, alcohol, phenol, silver nitrate etc. should be placed on the tray. This routine is carried out for every patient.

83. *Anesthetic Solution*

Ringer's solution may be made up in 100 cc. lots as often as necessary. Equipment necessary for making the anesthetic solution is; dissolving cup with holder, procain tablets, sterile gauze, alcohol or gas flame, and a 10 cc. graduate with straight sides. As this solution is to be injected into the patient, it is absolutely necessary for it to be sterile. Any carelessness on the part of the assistant might endanger the life of the patient. The dental officer will state how many cc's of anesthetic solution he wants. If three cc's are desired, three tablets of procaine hydrochloride are emptied from the little vial upon the sterile gauze. They should not be touched by the hands at any time. The use of cotton pliers is indicated in the handling of the tablets.

Measure three cc's of Ringers solution in the graduate and pour into a clean dissolving dish. Heat the solution over the flame until it reaches the boiling point. Drop into the solution the three tablets of procaine and heat a little more until they are completely dissolved. The solution is now ready to be placed in

the syringe. Since it is convenient not to remove the needles from the syringe once they are placed on, two syringes should be available. One having the one and five-eighths inch needle, and the other syringe equipped with the one inch needle. Take whichever syringe is indicated from the cabinet, and remove the little piece of wire that is placed through the needle. This is carefully laid to one side where it can be found again after the syringe has been used. Place the needle in the solution and draw up until the syringe is filled with the anesthetic solution. Place the barrel of the syringe against the inside of wrist to test for temperature. The ideal temperature for the solution is about body temperature. If the barrel feels too warm, place the syringe under a stream of cold water making certain that the water only touches the glass barrel. Place against the wrist and again test for temperature. The needle is then passed several times through the flame until it becomes slightly red in color. This can only be done with iridio-platinum needles, however, and if steel needles are used they should not be flamed. Hold the syringe so that the needle is pointing upward and slowly push the plunger until all the air has been expelled from the syringe. It is then handed to the dental officer or placed on the operating tray, taking precautions so that the needle does not touch anything. If this happens it is necessary to reflame the needle before using. After the syringe has been used, the plunger is removed from the barrel, the wire is placed in the needle and the entire syringe is placed in the sterilizer and boiled for a minimum of twenty minutes. After sterilizing, the syringe is assembled and placed back in the cabinet where it is ready to be used again.

84. *Impression Materials*

If an impression is to be taken, the necessary impression materials will be made available depending upon the type of impression. If modeling compound is used, the assistant should place a pan of water over the fire and heat it until the water is just a little too warm to allow the hand to be kept in the water. Several cakes of modeling compound are laid on a clean towel beside the hot water. The tray that has been selected by the dental officer is oiled slightly over its inner surface. If a hydro-colloid material is used, it is necessary to heat the pan of water to the boiling point. After the tray has been selected and attached to the water con-

nections of the unit by rubber tubing, the stick of hydro-colloid material is placed in the boiling water. The manufacturers' directions are followed as to the length of time that it is to be heated, but it is usually about 8 minutes. The tube containing the softened material is removed from the hot water and placed in water that is luke warm. The tube is kneaded between the fingers for a minute and then placed against the wrist to test the temperature. When it is warm but not uncomfortable it is ready to be taken into the operating room for use by the dental officer. There are numerous other duties that are too many to mention, but all will be mastered by the assistant if he is observing, and willing to learn.

85. *Filling Materials*

The mixing of the various dental filling materials is one of the most important duties of the chair assistant. The durability and appearance of the filling will depend upon its proper manipulation during this stage. There are several types of materials that are used, namely; gold, silver amalgam, oxyphosphate, copper amalgam, zinc oxide, silicate, gutta percha, etc. The filling materials that the chair assistant must prepare are known as plastics. In other words they are prepared and inserted while in a plastic stage and become hard after being placed in the tooth. This includes the amalgams and silicates which are known as permanent filling materials; and also oxyphosphate, zinc oxide, and gutta percha which are known as the temporary filling materials.

86. *Silver Amalgam*

The most common type of material that is used is the silver amalgam. It consists of the powdered metal portion containing silver, tin, and copper. This is mixed with mercury in the proportion of seven parts of alloy to five parts of mercury by weight or according to the manufacturers' directions. The mixture is placed in a glass mortar and triturated for three minutes or until the particles of metal have been thoroughly incorporated into the mercury. The mix is then placed in the palm of one hand and using the thumb of the other hand, it is thoroughly mixed until the material gives a slight metallic sound. Excess mercury should be expressed from the amalgam by the operator.

87. *Copper Amalgam*

Copper amalgam comes in small pellets with the mercury already included in the material. The pellet is placed in a spoon and heated slightly over a flame until the amalgam becomes soft. It is then placed in a mortar and triturated as was the silver amalgam. The excess amalgam that is left over after the filling is inserted may be saved and used again.

88. *Oxyphosphate of Zinc Cement*

Oxyphosphate of zinc cement can be used as a temporary filling material, or as a cement for gold crowns and inlays. The consistency of the mix should vary slightly according to the use to which it is put. If it is to be used for cementing crowns and inlays, the cement should be of a rather thin consistency so that it will occupy a minimum of space under the filling. If it is to be used as a filling material it should be mixed a little heavier in order to obtain a greater degree of strength for the filling. The more powder that is used in the mix, the stronger the cement will be. The powder comes in various shades ranging from dark yellow to snow white. When the shade of the powder is determined by the dental officer three small portions of the powder are placed on a clean glass slab. Three or more drops of the phosphoric acid liquid are placed on the slab about an inch away from the powder. Using a small metal spatula, the powder is gradually incorporated into the liquid, adding small portions of powder at a time and spatulating thoroughly. If the powder is added too fast, the mix will become hard and unmanageable as the setting time will be decreased. Continue adding small portions of powder and spatulating with a rotary motion until the cement has a tendency to string out from the spatula when it is raised, and then falling back forming a little mound which retains its shape. A great deal of practice will be required before the proper mixture can always be obtained. The chair assistant should always mix the cement under the supervision of the dental officer until he has attained this proficiency.

89. *Silicate*

The silicates or synthetic porcelain filling materials require the greatest care in mixing. There are so many variable factors that influence the silicates that the most rigid routine must be

followed. The silicate powders come in numerous shades, each one having a number. The desired shade is determined by the dental officer from the silicate shade guide. The shade decided upon, the next step is to make certain that all the equipment that is necessary for the filling is ready. None of the materials such as glass slabs, spatulas, etc., should be used for any other purpose than for silicate fillings. The metal spatula for mixing and the plastic instruments used in inserting the filling in the tooth, are made from a special metal alloy, either stainless steel or stellite. As the various powders may be mixed to give the exact shade desired, a special silicate shade guide is used on which are given the correct proportions of each powder to obtain this shade. Some of the shades will require an even mix of two powders and other shades will require one portion of one powder to two portions of another shade. Each silicate set contains a metal scoop used to determine the correct amount of the powder. This scoop has small spoon-like ends, one end smaller than the other. The small end is used to measure the powder when a mix calls for one portion of one powder to two portions of another powder. The larger end is used to measure the powder when the mix calls for equal portions of two powders. Depending upon the shade selected, the powder is measured as directed, and placed upon a clean, dry glass slab. A word of warning about the slab; in hot weather the slab should first be cooled with cold water and dried before attempting to mix the silicate. The ideal temperature is between 65° and 75° F. Moisture of any sort will affect the strength of the final filling. The silicate set contains a box of celluloid strips. One or two of these strips are placed upon the operating tray. They will be used by the dental officer as a matrix in the insertion of the filling. Three full drops of the liquid are always used when the powder is measured out as directed. These three drops are placed on the glass slab about an inch away from the powder. Add about one third of the powder to the liquid and spatulate for not more than 20 seconds. Add another third of the powder and spatulate for the same time. The final third of the powder is then added and the spatulation is completed when the mixture has the consistency of soft putty. The entire mix should never be spatulated for more than one minute, and the spatulation should be done lightly, using a patting motion instead of the rotary motion used in mixing cements.

90. *Zinc Oxide*

Zinc oxide and eugenol are used extensively as a temporary filling material because of their sedative action. Three or more drops of eugenol are placed on a glass slab. Enough zinc oxide powder is placed on the slab for that particular filling. The powder is incorporated into the eugenol with a metal spatula until it is thoroughly mixed. The resultant mixture is rolled into a small ball and squeezed between two pieces of gauze, thus expressing some of the oil. When the mixture is of the proper consistency for insertion in the cavity, it is placed on the operating tray.

Section V

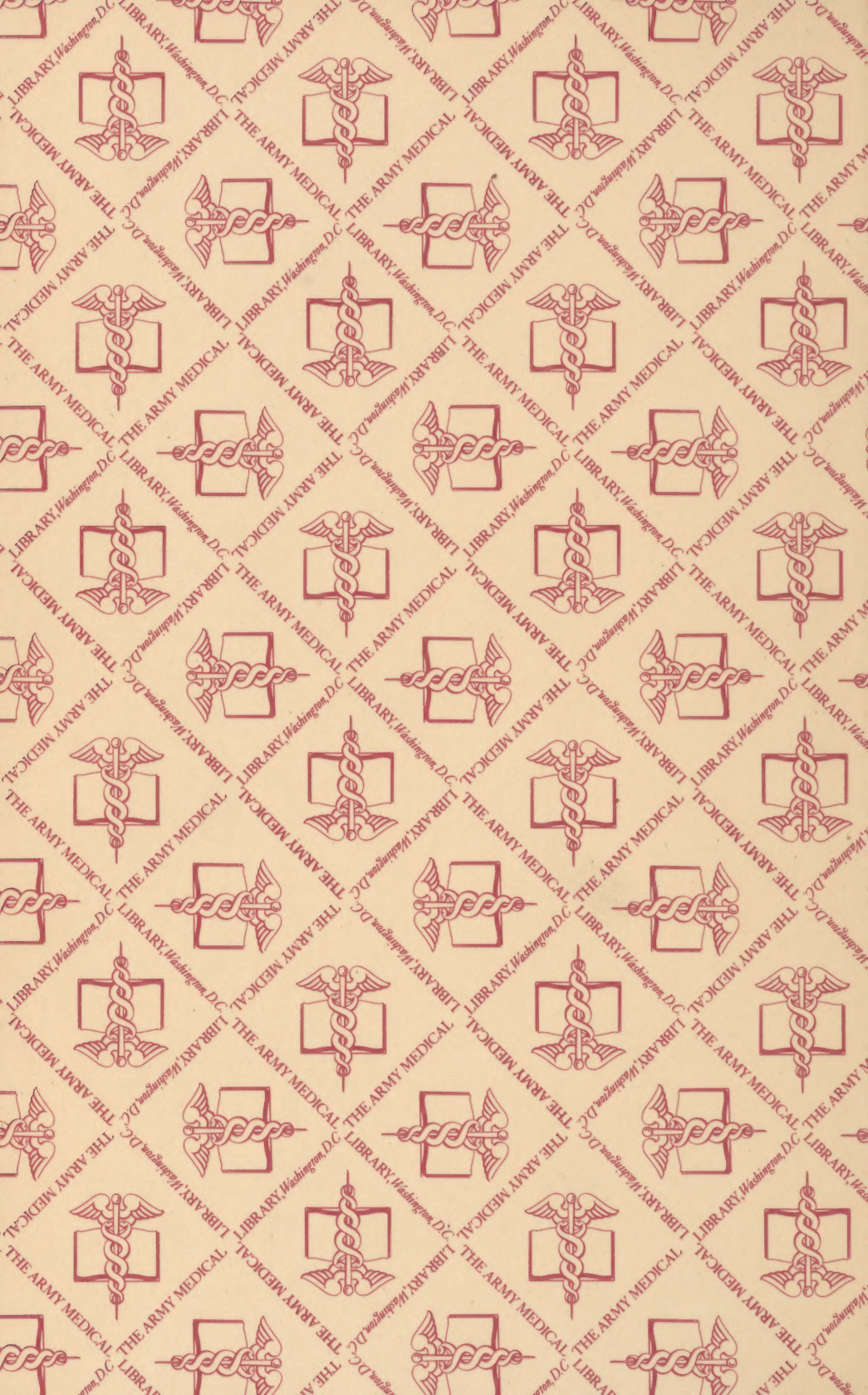
Clerical Duties

91. *General*

At a large number of military posts it is the duty of the chair assistant to obtain from the patient the necessary information for the dental forms, to make appointments and to do some clerical work. All dental work should be done by appointment unless it is of an emergency nature. That is the purpose of the daily sick call. Each station has a time set aside every day to perform the emergency work. These patients are always given priority over the routine appointments. As is often the case, the chair assistant is required to perform some of the clerical duties; the following procedure may be used as a guide.

When a patient reports for dental treatment, he is asked if he has had any dental treatment at the present station during the calendar year. If he has had treatment, his previous register card is taken from the files. If he has had no treatment during the current year, the clerk should ascertain if the patient was a member of the command at the time the annual survey was made and to which organization he belonged at the time. If surveyed, the clerk will find the name on the survey record. He then fills in the heading of Form 79 with the proper data, making certain that all the information is complete. If the patient is serving with an organization of which he is not a member, his proper organization should be given in the allotted space and his present temporary assignment noted at the top of the form merely for locating the patient. If the individual has been surveyed, his classification will be noted in space 2 of the register card. If the patient has not been surveyed during the current year,

only the heading is made out by the clerk. The assistant then ushers the patient into the office and seats him in the chair. His record card is brought in for the information of the dental officer. A clean towel is placed around the patient's neck and the assistant stays in the same room, so that he may assist the dental officer whenever needed. After the dental work has been completed on the patient for the day, the patient is dismissed and if necessary another appointment is given him at this time. The operation performed is then noted by the dental officer on the card with the change of classification, if any. While the operator is making these notations, the assistant prepares the room for the next patient. The operating tray is cleared of all instruments and a clean piece of paper is placed on the tray. All the used instruments are scrubbed and placed in the sterilizer. The handpiece is carefully sterilized and clean exploring points and mouth mirrors are placed on the tray. In general this is the procedure to be followed for each patient during the day's work and although the duties of the assistant will vary depending upon the type of work being done for the patient, these fundamental duties will always be performed.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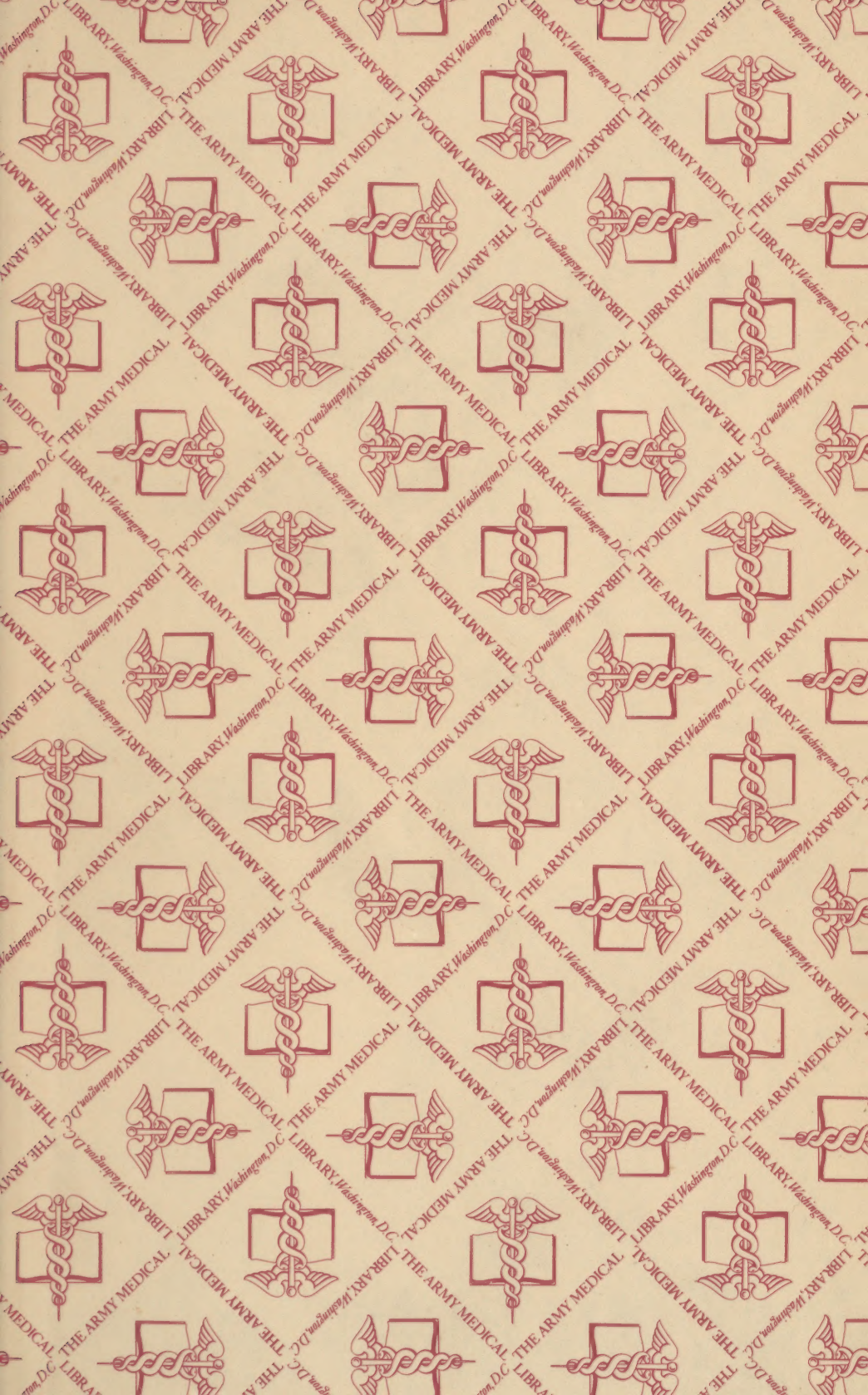
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